MINES AND MINERAL DEPOSITS (EXCEPT FUELS) PARK COUNTY, MONT.

BY GLENN C. REED

* * * * * * * * * **Information Circular 7546**

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[1] Mining engineer, Mining Division, Bureau of Mines.

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INTRODUCTION

This report is one of a series based upon investigations made and being made within the Missouri River Basin in Montana by engineers of the Bureau of Mines, Albany Branch, Mining Division. These investigations are made primarily to provide preliminary information to the Department of Interior agencies and to others concerned with planning the proposed Federal power development within the Missouri River Basin. The present report has been designed to permit public distribution of factual data obtained.

The field investigations were made during the late fall of 1947 and the summer of 1948. Information on mineral occurrences in several areas in Sweet Grass County also are included in this report because of their close proximity to Park County. Practically all known metallic mineral deposits within Park County were investigated; some nonmetallic mineral deposits also were investigated. The investigations of the metallic mineral deposits in Park County cannot be considered complete; some long inactive mines and prospects on which little or no information is of record may have been missed. Many of the underground openings, especially at the long inactive properties, no longer are accessible; consequently, much of the information regarding their history and development necessarily has been obtained from available Federal and State publications.

ACKNOWLEDGMENTS

Many prospectors, mine owners, and company officials throughout the region assisted greatly in the compilation of many of the data presented in this report. Essential information concerning company activities as related to the mineral industry within the county was provided by officials of the Anaconda Copper Mining Co., the American Smelting & Refining Co., the Montana Power Co., and the Northern Pacific Railroad.

Detailed statistical information was supplied by the U. S. Weather Bureau, Helena, Mont., and the Economics and Statistics Division, Bureau of Mines, Salt Lake City, Utah, and Washington, D. C.

Much valuable information was obtained from reports and unpublished manuscripts of the Montana Bureau of Mines and Geology, the Federal Geological Survey, the Federal Bureau of Mines, and other sources. Acknowledgment of the source of such information is indicated in the text by numbers, which indicate references at the end of the report.

LOCATION AND ACCESSIBILITY

Park County (population 11,609) is in south-central Montana between parallels 45° and 46° 11' north and meridians 109° 50' and 111° 02' west.

Its borders enclose an area of 2,633 square miles. The mineral deposits of this county are confined mainly to seven mining districts distributed throughout a region of about 2,000 square miles surrounding Livingston, Mont. (population 6,642), the county seat. The location of these districts and their relation to highways, railroads, and population centers are shown in figure 1.

Road mileage between the various mining districts and the nearest rail shipping points are indicated in table 1:

TABLE 1. - Distances from Park County mining districts to nearest shipping points, Northern Pacific Railroad

District or area	Shipping point	Road mileage		
		Surfaced or improved	Unimproved	Total
New World	Gardiner	56	6	62
Jardine	Gardiner	6	-	6
Emigrant	Emigrant	5	2	7
Crevasse	Gardiner	6	4	10
Independence	Big Timber[1]	28	[2]25	53
Mill Creek	Emigrant	7	[2]12	19
Goose Lake	Gardiner	56	[2]9	65
Crazy Mountains	Big Timber[1]	11	[3]16	27

[1] Sweet Grass County.
[2] Accessible by 4-wheel drive unit only.
[3] Accessible by pack trail only.

The nearest large supply point is Billings, Mont., although major items of mine equipment are more commonly obtainable at Butte and Helena. Smelting facilities are available at Anaconda, East Helena, and Great Falls, Mont. Table 2 gives highway mileage from Livingston to the principal mining supply points and smelting centers within Montana, together with similar major centers in several nearby States.

TABLE 2. - Highway distances from Livingston, Mont.

Place	Mileage
Anaconda, Mont.	147
Billings, Mont.	116
Butte, Mont.	122
East Helena, Mont.	124
Great Falls, Mont.	173
Helena, Mont.	127
Kellogg, Idaho	379
Salt Lake City, Utah	422
Spokane, Wash.	452

The county is roughly quartered by a highway network essentially paralleling trackage of the Northern Pacific system. Branching secondary and unimproved county roads make possible access to most parts of the region in spite of the fact that it contains some of the most rugged topography within

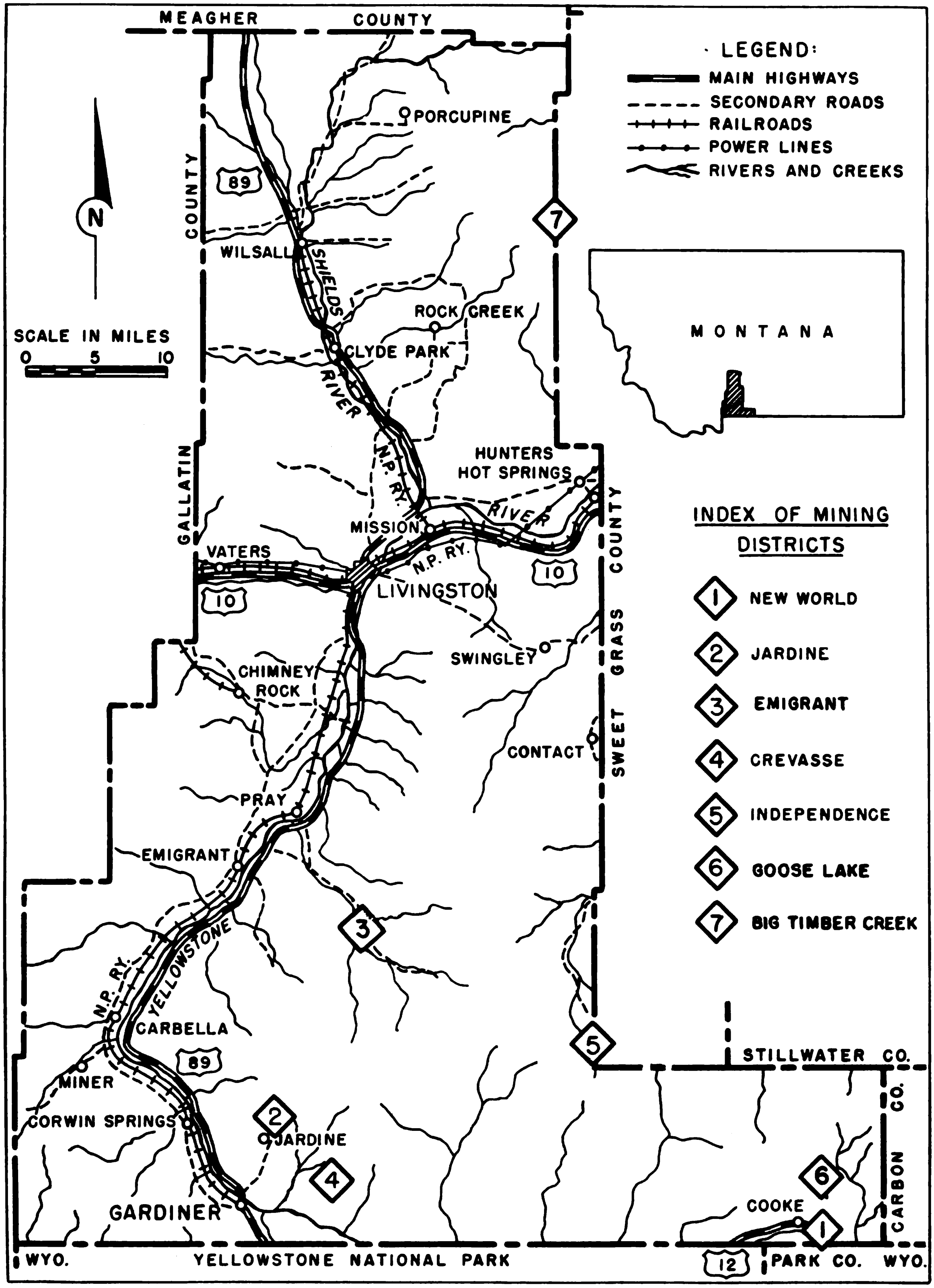

Figure 1. - Index map, Park County, Mont.

the United States. Most of the mining areas may be reached easily by motor vehicles during the summer and early fall. Access to several districts is possible only by 4-wheel drive units, pack animals, or foot.

CLIMATE

The expected climatic contrasts between the low valley floors and mountainous uplands of Park County, Mont. are further accentuated by the wide seasonal temperature variations common to the northern Rocky Mountain province.

The usually mild summer months are succeeded by an extended storm period and decreasing temperatures. The average monthly precipitation reaches maximum values in May and June, which decline to minimum values in December and January.

Although snowstorms may, and usually do, occur in every month of the year, communications at the lower altitudes are often unhampered from April to December. The higher altitudes are marked by heavy snowfall, and many of the mountains are snow-capped the entire year. Consequently, destructive snowslides are common in the more precipitous uplands. Remnant glaciers exist in at least two areas within the region.

Climatological data recorded at stations in and adjacent to Park County, Mont., are shown in tables 3 and 4. The indicated statistics were supplied by the United States Weather Bureau, Helena, Mont.

TABLE 3. - Average monthly and annual precipitation[1] and snowfall, in inches, at U. S. Weather Bureau stations in and adjacent to Park County, Mont.

Station	Livingston, Park County		Big Timber, Sweet Grass County		Mystic Lake, Stillwater County		Northeast entrance, Yellowstone Park	
Elevation, ft.	4,485		4,100		6,558		7,349	
	Precipitation	Snowfall	Precipitation	Snowfall	Precipitation	Snowfall	Precipitation	Snowfall
Length of record, yr.	44	28	42	24	21	6	4	4
January........	0.56	9.5	0.64	9.4	1.11	15.8	1.52	15.9
February.......	.54	6.5	.68	5.8	1.22	13.4	1.58	15.0
March..........	.86	7.4	1.00	9.6	1.76	19.2	2.00	24.7
April..........	1.32	3.9	1.22	5.4	2.91	24.3	1.27	10.2
May............	2.44	1.1	2.69	1.7	4.07	9.3	3.07	6.7
June...........	2.04	Trace	1.97	.1	2.71	.2	4.94	3.1
July...........	1.26	0.0	1.38	.0	2.30	.0	1.50	.0
August.........	1.12	.1	1.12	Trace	1.74	.1	1.63	.0
September......	1.58	.7	1.35	.9	2.16	4.6	2.81	5.5
October........	1.17	3.9	1.41	6.6	1.48	17.1	1.98	6.3
November.......	.80	8.9	.75	10.1	1.40	25.6	2.15	25.8
December.......	.60	7.4	.53	6.5	1.18	10.5	2.28	27.4
Annual average.	14.29	49.4	14.74	56.1	24.04	140.1	26.73	140.6

[1] Includes snowfall converted to water.

TABLE 4. - Average temperatures, °F., at U. S. Weather Bureau stations in and adjacent to Park County, Mont.

Station	Livingston, Park County	Big Timber, Sweet Grass County	Mystic Lake, Stillwater County	Northeast entrance, Yellowstone Park
Elevation, ft.	4,485	4,100	6,558	7,349
Length of record, yr...	28	25	6	4
Annual average.........	45.9	46.3	41.2	35.1
Mean maximum:				
January..............	34.6	35.8	29.2	25.4
July.................	83.0	86.4	73.7	76.7
Annual...............	58.0	59.8	50.3	49.1
Mean minimum:				
January..............	16.2	14.9	14.0	2.0
July.................	50.9	52.4	52.4	38.1
Annual...............	33.8	32.8	32.1	21.5
Highest:				
January..............	60.0	68.0	52.0	-
July.................	106.0	106.0	90.0	-
Annual...............	106.0	107.0	90.0	92.0
Lowest:				
January..............	-39.0	-36.0	-31.0	-
July.................	35.0	33.0	35.0	-
Annual...............	-40.0	-44.0	-35.0	-34.0
Latest date 32° or lower in Spring......	May 5 to June 20	May 3 to June 19	May 31 to June 21	1/
Earliest date 32° or lower in Fall.......	Aug. 24 to Oct. 11	Aug. 24 to Oct. 8	Aug. 31 to Sept. 20	1/

1/ Below freezing temperature recorded every month except during unusual year.

TOPOGRAPHY

The elevated region comprising Park County, Mont., presents an almost endless variety of spectacular alpine features. Much of this region is 7,000 feet above sea level, with occasional peaks reaching upward 10,000 to 11,000 feet or more in altitude. Numerous plateau areas at altitudes ranging between 9,000 and 10,000 feet occur in the southeast part of the county. With the exception of relatively small parts of the Yellowstone and Shields River Basins, the land mass within the county is well above 5,000 feet in altitude.

The western margin of Park County is marked by the lower slopes of the Gallatin and Bridger Ranges. To the east, the massive Absaroka Range and the Snowy Mountains rise precipitously from the floor of the broad, north-trending Yellowstone River Valley.

The Bridger Range on the west and the peculiarly isolated mass of the rugged Crazy Mountains to the east together form the south-trending drainage basin of the Shields River. This river joins the Yellowstone River a short distance east of Livingston, Mont.; the two rivers thus comprise the main drainage channels of the county.

The north part of the county, including the Shields drainage basin, gradually ascends a series of gently rolling foothills along the lower outlying flanks of the Little Belt Mountains.

TIMBER

The broad valleys, rolling foothills, and those mountain slopes above 9,500 feet in altitude are either treeless or only sparsely wooded. In general, the greater part of the commercial timber supply is restricted mainly to the southeastern part of the county. Additional small stands of marketable-grade timber occur on the western flanks of the Crazy Mountains and the higher eastern slopes of the Bridger Range. The timbered areas are almost entirely within the National Forest boundaries.

Lodgepole pine is the most prevalent variety; fir, spruce, and balsam usually are sparsely distributed throughout the forested areas. Many of the streams, springs, and water courses are marked by small groves of aspen, a variety usually unsuited for construction.

WATER SUPPLY

Essentially all of the recognized mining districts within the county are abundantly supplied with water. In several areas, topography and available water supply are so related as to encourage small-scale development of hydroelectric power. With the exception of the New World and Jardine districts, none of the mining enterprises adjacent to these favored areas have to date been deemed large enough to warrant the capital expenditure required for development of hydroelectric energy.

An adequate water supply for domestic and industrial uses can be obtained with little difficulty in most of the districts. The related problems of tailings disposal and stream contamination, however, are viewed with generally increasing concern by agricultural interests.

Although only one of the county's few active mines was operating below gravity drainage level, a number of flooded mine workings were observed in the Crevasse, New World, and Goose Lake districts. Inasmuch as evidence of any substantial flow from these workings was lacking, it may be assumed that most excess ground water can be removed by modern equipment at nominal cost.

HISTORY

The history of mining in Park County is largely the record of discovery and development of mineral deposits in the Jardine and New World (Cooke) districts. Placer gold was first found by George Phelps in gravels along the Yellowstone River near Gardiner in 1862. In 1866 placer gold was found near the mouth of Bear Gulch. A continuing search for the origin of these placer deposits finally was rewarded in 1870 when gold quartz veins were discovered at the present site of Jardine.

Meanwhile, persistent rumors reporting the existence of rich mineral deposits in the New World district were verified in 1869 when the Republic vein outcrop was found by trappers fleeing an Indian raiding party. During the following summer, a number of lode and placer claims were staked in the district.

After the establishment of base camps at Jardine and Cooke, the search for mineral deposits in nearby areas resulted in discoveries in the Crevass and Goose Lake districts.

Exploitation of the deposits generally followed the customary pattern of promotion, brief intervals of development or expansion, and longer periods of idleness often marked by receivership and reorganization. The Jardine district has been comparatively active since discovery, with the exception of an extended period of litigation from 1909 to 1916 and a shutdown from 1926 to 1932. It is noteworthy that a tungsten mineral was recognized in the Jardine ores in 1904 when several shipments of hand-sorted scheelite ore were made to Germany. These shipments are among the earliest recorded for domestic tungsten production.

In 1904, a cyanide plant was added to the Jardine milling facilities, which were further improved by the installation of flotation equipment in 1922. Operations were suspended in 1942 by Federal restrictions on gold mining. Increasing war demands for arsenic, however, led to the reopening of the property, which later operated uninterruptedly to May 1948, when the cyanide plant was destroyed by fire.

Exploitation of the New World district was intensified in 1882, when the area was withdrawn from Indian lands and opened to settlement. A lead smelter and roasting furnace were erected and successfully operated for a short period on ores from the Republic vein. Prohibitive freight rates on base bullion forced the termination of operations in 1887.

Continued prospecting in the New World district during the succeeding years resulted in a few shipments of lead-silver ores. In the early 1900's attention was directed to the district's pyritic-gold-copper ores. After an interval of promotions and reogranizations, the Western Smelting & Power Co. constructed a 250-kilowatt hydroelectric plant to supply energy for a 350-ton copper smelter erected in the upper Clakr Fork Basin. A long adit designed to develop ores exposed on Henderson Mountain failed in its objective and the operation terminated. The smelter, which was never "blown in," has been largely dismantled in recent years. The hydroelectric plant is in ruins.

In 1920, exploration proceeding under the direction of L. H. Brooks resulted in the location and development of the Irma property on Republic Mountain. This operation has continued to the present time as a small but consistent producer of lead and zinc concentrates.

In 1933, claims on Red Mountain were acquired by the McLaren Gold Mines Co. A concentrator, later destroyed by fire, was completed in 1934. McLaren Gold Mines Co. stock was purchased by the Newmont Mining Corp., and in 1939 considerable exploratory core drilling was done. The stock was resold to McLaren Gold Mines Co., and Newmont's interest in the property terminated. The concentrator was rebuilt, and the open-cut mining of low-grade pyritic-gold-copper ores was continued by the McLaren Gold Mining Co. The operation has since been expanded considerably and milling facilities have been improved. It now is one of the State's important gold-copper producers.

In 1942, an urgent war-born demand for optical-grade calcite led to the opening of several deposits in the vicinity of Wilsall, Clyde Park, and Springdale. An intensive program of exploration and development jointly sponsored by the War Production Board and the Bureau of Mines resulted in the production of a quantity of acceptable, optical-grade material.

Large-scale placer operations were attempted at Emigrant, Mont., in 1941, when a 10-cubic foot Yuba dredge was installed by the Emigrant Dredging Co. of Kansas City, Mo. Operations were suspended in 1942 because of Federal restrictions on gold mining but resumed in 1946. Because of difficult ground and its low gold content, the operation was terminated in 1948. The dredge has been dismantled and sold.

A great number of small-scale placer operations have been undertaken along the Yellowstone River, in Bear Gulch near Jardine, at Crevasse Mountain, and in areas within and adjacent to the New World district. These operations were characteristically short-lived; their aggregate production over the years was of only minor importance.

PRODUCTION

Dependable statistics from the year of county organization in 1887 to 1947, inclusive, indicate that Park County has produced base and precious metals valued at $8,114,000. Although placer gold accounts for 12 percent of this metal output, about 77 percent of the total production during the period was recovered in gold from lode mining. The combined value of lode and placer gold output therefore, is, about $7,251,000, or 89 percent of the county's total metal production. The total value of silver, copper, lead, and zinc produced has amounted to $864,000, or nearly 11 percent.

Although placer gold was first discovered in the Park County region near Gardiner in 1862, no reliable record of metal-mining operations or production is available for the period 1862-1886. Due to the complete absence of authentic data, no estimate of metal production for this interval has been attempted. It is believed, however, that the total metal production for this earlier period probably did not exceed $500,000 in value.

Total county metal output by years is given for the period 1887-1947 in table 5. Metal output by districts for the period 1901-1947 is shown in tables 6 to 10 and summarized in table 11. These tables have been compiled from data supplied by the Economics and Statistics Division, Bureau of Mines, Salt Lake City, Utah. It should be noted that the tables are expressed in terms of recoverable metal and therefore do not indicate the true metal content of the ores mined.

TABLE 5. - Mine production of gold, silver, copper, lead, and zinc in Park County, Mont., 1887-1947, in terms of recovered metals

Year	Producing mines		Ore sold or treated	Gold				Silver		Copper		Lead		Zinc		Total value
				Fine ounces				Fine ounces								
	Lode	Placer	short tons	Lode	Placer	Total	Value	Lode & placer	Value	Pounds	Value	Pounds	Value	Pounds	Value	
1887	1/	1/	1/	1/	1/	194	$4,013	-	-	-	-	-	-	-	-	$4,013
1888	do	do	do	do	do	242	5,000	-	-	-	-	-	-	-	-	5,000
1889	do	do	do	do	do	175	3,618	5,000	$4,700	-	-	-	-	-	-	8,318
1890	do	do	do	do	do	65	1,350	-	-	-	-	-	-	-	-	1,350
1891	do	do	do	do	do	1,010	20,889	106	105	-	-	-	-	-	-	20,994
1892	do	do	do	do	do	2,468	51,008	407	354	-	-	-	-	-	-	51,362
1893	do	do	do	do	do	3,015	62,321	591	461	-	-	-	-	-	-	62,782
1894	do	do	do	do	do	1;747	36,123	197	124	-	-	-	-	-	-	36,247
1895	do	do	do	do	do	2,750	56,838	828	538	-	-	-	-	-	-	57,376
1896	do	do	do	do	do	1,680	34,732	570	388	-	-	-	-	-	-	35,120
1897	do	do	do	do	do	423	8,751	60	36	-	-	-	-	-	-	8,787
1898	do	do	do	do	do	642	13,263	104	64	-	-	-	-	-	-	13,327
1899	do	do	do	do	do	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/
1900	do	do	do	do	do	do	do	do	do	do	do	do	do	do	do	Do
1901	4	-	1,260	320	-	320	6,621	318	191	-	-	-	-	-	-	6,812
1902	4	-	27,503	15,785	-	15,785	326,276	3,286	1,639	-	-	200	$4	-	-	327,919
1903	2	1	30,398	6,243	14	6,257	129,332	-	-	-	-	-	-	-	-	129,332
1904	2	2	2,482	2/	2/	3,073	63,524	3,333	1,907	-	-	-	-	-	-	65,431
1905	3	3	4,021	2,170	279	2,449	50,623	840	507	-	-	-	-	-	-	51,130
1906	2	4	218	319	71	390	8,066	122	82	3,316	$640	-	-	-	-	8,788
1907	2	4	1,700	1,005	101	1,106	22,870	6,410	4,231	-	-	130,000	6,890	-	-	33,991
1908	2	6	344	292	65	357	7,369	70	37	-	-	-	-	-	-	7,406
1909	1	3	2,500	525	6	531	10,983	200	104	-	-	-	-	-	-	11,087
1910	2	-	153	16	63	79	1,628	2,144	1,159	-	-	148,488	6,533	-	-	9,320
1911	3	6	58	28	108	136	2,810	264	140	-	-	29,866	1,344	-	-	4,294
1912	6	4	179	85	34	119	2,469	330	203	-	-	-	-	-	-	2,672
1913	-	4	-	-	124	124	2,554	16	10	-	-	-	-	-	-	2,564
1914	-	5	-	-	43	43	888	4	2	-	-	-	-	-	-	890
1915	-	5	-	-	115	115	2,367	19	10	-	-	-	-	-	-	2,377
1916	2	1	32	7	26	33	687	616	405	-	-	6,086	420	-	-	1,512
1917	6	3	165	112	12	124	2,571	1,004	827	1,154	315	38,229	3,288	-	-	7,001
1918	4	2	3,630	1,074	28	1,102	22,785	2,030	2,030	-	-	43,168	3,065	-	-	27,880
1919	3	2	3,986	1,998	67	2,065	42,682	3,463	3,879	251	47	58,985	3,126	-	-	49,734
1920	3	2	20,292	3,316	23	3,339	69,014	11,397	12,423	1,461	269	95,680	7,654	-	-	89,360
1921	2	3	7	5	45	50	1,038	79	79	73	9	1,292	58	-	-	1,184
1922	3	3	36,921	7,836	18	7,854	162,353	2,493	2,493	-	-	33,962	1,868	-	-	166,714
1923	2	1	44,546	8,050	2	8,052	166,449	4,938	4,049	182	27	31,529	2,207	-	-	172,732
1924	5	1	49,246	10,044	3	10,047	207,681	2,318	1,553	-	-	8,368	670	-	-	209,904
1925	1	1	69,409	14,182	1	14,183	293,199	1,511	1,049	-	-	-	-	-	-	294,248
1926	2	-	24,631	5,388	-	5,388	111,386	631	394	-	-	-	-	-	-	111,780
1927	1	1	40	110	5	115	2,380	14	8	-	-	-	-	-	-	2,388
1928	1	-	1	4	-	4	88	-	-	-	-	-	-	-	-	88
1929	2	-	415	11	-	11	221	14,739	7,856	76	13	166,749	10,505	-	-	18,595
1930	1	4	2	-	26	26	543	397	153	-	-	654	33	-	-	729
1931	1	4	70	117	51	168	3,467	24	7	-	-	-	-	-	-	3,474
1932	3	7	3,048	1,596	302	1,898	39,230	404	114	-	-	-	-	-	-	39,344
1933	5	13	22,995	5,474	631	6,105	126,196	1,723	603	500	32	-	-	-	-	126,831
1934	6	32	35,349	5,060	839	5,899	206,176	10,709	6,923	1,500	120	38,162	1,412	-	-	214,631
1935	7	20	45,271	6,967	832	7,799	272,979	2,002	1,439	1,880	156	300	12	-	-	274,586
1936	12	9	48,187	6,308	313	6,621	231,742	47,592	36,860	44,250	4,071	179,239	8,245	-	-	280,918
1937	4	16	65,929	12,596	413	13,009	455,315	28,000	21,658	158,000	19,118	184,000	10,856	-	-	506,947
1938	7	4	50,537	8,013	216	8,229	288,015	6,217	4,019	6,204	608	22,370	1,029	-	-	293,671
1939	5	5	52,919	8,416	211	8,627	301,945	7,375	5,006	58	6	30,318	1,425	-	-	308,382
1940	5	7	67,919	10,386	442	10,828	378,980	12,967	9,221	36,000	4,068	61,400	3,070	-	-	395,339
1941	4	8	91,147	13,952	2,191	16,143	565,005	64,291	45,718	105,500	12,449	288,300	16,433	160,000	$12,000	651,605
1942	3	9	25,175	5,547	4,352	9.899	346,465	34,584	24,593	148,000	17,908	126,100	8,449	95,000	8,835	406,250
1943	2	4	10,490	1,292	12	1,304	45,640	17,055	12,128	99,700	12,961	79,000	5,925	41,000	4,428	81,082
1944	3	2	72,408	11,004	6	11,010	385,350	24,075	17,120	200,800	27,108	108,400	8,672	85,000	9,690	447,940
1945	4	1	49,723	8,451	3	8,454	295,890	22,050	15,680	41,800	5,643	171,500	14,749	134,200	15,433	347,395
1946	4	1	83,999	15,686	2,875	18,561	649,635	32,005	25,860	356,700	57,785	205,000	22,345	169,000	20,618	776,243
1947	4	2	109,249	16,353	1,918	18,271	639,485	44,980	40,707	451,600	94,836	234,000	33,696	236,000	28,556	837,280
Totals			1,158,554	216,143	16,886	250,513	$7,250,878	426,902	$321,846	1,659,005	$258,189	2,521,345	$183,983	920,200	$99,560	$8,114,456

1/ Information not available.
2/ Separation of lode and placer not available.

TABLE 6. - Mine production of gold, silver, copper, and lead[1] in the Jardine mining district, Park County, Mont., 1901-1947, in terms of recovered metals

Year[2]	Tons ore sold or treated	Gold, ounces			Silver,[3] fine ounces	Copper, pounds	Lead, pounds	Total value
		Lode	Placer	Total				
1902.......	26,400	15,522	-	15,522	3,120	-	-	$323,908
1903.......	30,178	6,197	13	6,210	-	-	-	128,381
1904.......	2,482	[3]	[3]	3,073	3,333	-	-	65,431
1905.......	2,300	1,518	50	1,568	806	-	-	32,902
1906.......	-	-	53	53	5	-	-	1,104
1907.......	1,500	1,003	56	1,059	242	-	-	22,060
1908.......	126	63	38	101	33	-	-	2,107
1909.......	-	-	5	5	2	-	-	111
1911-1918[4]	-	-	-	-	-	-	-	-
1919.......	3,900	1,965	-	1,965	346	-	-	41,003
1920[4].....	-	-	-	-	-	-	-	-
1921.......	7	5	-	5	72	73	1,292	249
1922.......	36,883	7,834	-	7,834	1,325	-	-	163,268
1923.......	44,429	8,048	-	8,048	995	-	-	167,191
1924.......	49,177	9,987	-	9,987	1,347	-	-	207,342
1925.......	69,409	14,182	-	14,182	1,511	-	-	294,227
1926.......	24,586	5,355	-	5,355	626	-	-	111,102
1927.......	40	110	-	110	13	-	-	2,284
1928.......	1	4	-	4	-	-	-	88
1931.......	70	117	-	117	16	-	-	2,428
1932.......	2,738	1,393	-	1,393	305	-	-	28,887
1933.......	22,422	4,838	11	4,849	900	-	-	100,542
1934.......	29,617	4,105	-	4,105	812	1,275	-	144,088
1935.......	38,777	6,073	3	6,076	1,095	470	-	213,486
1936.......	40,754	4,820	-	4,820	980	250	-	169,489
1937.......	53,355	10,034	178	10,212	1,550	-	-	358,619
1938.......	49,651	7,590	-	7,590	1,284	-	-	266,480
1939.......	51,241	8,275	-	8,275	1,628	-	-	290,730
1940.......	57,812	9,317	-	9,317	1,866	-	-	327,422
1941.......	69,469	7,436	-	7,436	1,689	1,400	-	261,626
1942.......	2,799	700	-	700	218	900	-	24,764
1944.......	50,430	7,143	-	7,143	1,942	-	-	251,386
1945.......	45,217	7,812	-	7,812	1,620	-	-	274,572
1946.......	52,040	9,822	-	9,822	1,760	-	-	345,192
1947.......	68,149	10,140	-	10,140	1,821	-	-	356,548
Totals.	925,959	171,408	407	174,888	33,262	4,368	1,292	4,979,017

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[1] No zinc produced.
[2] No production reported for years omitted from table.
[3] Combined lode and placer production.
[4] County production breakdown by districts not available.

TABLE 7. - Mine production of gold, silver, copper, lead, and zinc in the New World mining district, Park County, Mont., 1901-1947, in terms of recovered metals

Year[1]	Tons ore sold or treated	Gold, ounces			Silver,[2] fine ounces	Copper, pounds	Lead, pounds	Zinc, pounds	Total value
		Lode	Placer	Total					
1901	40	44	-	44	10	-	-	-	$917
1902	3	2	-	2	54	-	200	-	68
1906	18	11	-	11	71	3,316	-	-	911
1907	200	2	-	2	6,160	-	130,000	-	11,003
1910	152	12	-	12	2,132	-	148,488	-	7,938
1911	45	2	-	2	237	-	29,866	-	1,511
1912	101	45	-	45	311	-	-	-	1,238
1913-1916	-	-		-	-	-	-	-	-
1917	45	6	-	6	746	-	32,076	-	3,506
1918	76	28	-	28	1,829	-	43,168	-	5,476
1919	86	33	-	33	3,111	251	58,985	-	7,339
1920	292	9	-	9	10,623	1,461	95,680	-	9,698
1922	33	2	-	2	1,165	-	33,962	-	3,076
1923	117	2	-	2	3,943	182	31,529	-	5,500
1924	32	-	-	-	959	-	8,368	-	1,318
1929	415	11	-	11	14,739	76	166,749	-	18,595
1930	2	-	-	-	391	-	654	-	186
1932	10	61	-	61	14	-	-	-	1,265
1933	566	627	195	822	760	500	-	-	17,289
1934	3,732	803	5	808	9,733	225	38,162	-	35,954
1935	4,748	693	-	693	537	1,410	300	-	24,755
1936	5,010	1,258	-	1,258	46,532	44,000	179,239	-	92,369
1937	12,046	2,536	-	2,536	26,406	158,000	184,000	-	139,159
1938	440	362	-	362	4,885	6,204	22,370	-	17,465
1939	513	7	-	7	5,694	58	30,318	-	5,541
1940	10,107	1,069	-	1,069	11,025	36,000	61,400	-	52,393
1941	21,678	6,516	1	6,517	62,294	104,100	288,300	160,000	313,110
1942	22,376	4,847	-	4,847	33,743	147,100	126,100	95,000	228,723
1943	10,490	1,292	-	1,292	17,055	99,700	79,000	41,000	80,662
1944	21,978	3,861	-	3,861	22,133	200,800	108,400	85,000	196,344
1945	4,506	639	-	639	20,430	41,800	171,500	134,200	72,718
1946	31,954	5,863	-	5,863	29,500	365,500	204,800	169,000	329,735
1947	41,100	6,213	-	6,213	42,864	451,600	234,000	236,000	413,335
Totals	192,916	36,856	201	37,057	380,086	1,653,283	2,507,614	920,200	$2,099,097

[1] No production reported for years omitted from table.

[2] Combined lode and placer production.

3420 [3] Breakdown of county production by districts not available.

TABLE 8. - Mine production of gold and silver[1/] in the Crevasse mining district, Park County, Mont., 1901-1947, in terms of recovered metals

Year[2/]	Tons ore sold or treated	Gold, ounces			Silver,[3/] fine ounces	Total value
		Lode	Placer	Total		
1901	20	6	-	6	-	$124
1905	1,721	652	-	652	-	13,477
1906	200	308	-	308	43	6,405
1908	218	229	1	230	35	4,764
1909	2,500	525	-	525	198	10,955
1910	1	4	-	4	1	83
1911-1918[4/]	-	-	-	-	-	-
1920[4/]	-	-	-	-	-	-
1924	37	57	-	57	12	1,182
1926	45	33	-	33	5	678
1932	300	142	-	142	39	2,941
1933	7	9	-	9	-	186
1934	2,000	153	-	153	31	5,353
1935	1,746	201	-	201	231	7,216
1936	2,423	230	-	230	40	8,074
1937	528	26	-	26	9	917
1938	446	61	-	61	31	2,155
1939	1,165	134	-	134	25	4,707
Total	13,357	2,770	1	2,771	700	69,217

[1/] No copper, lead, or zinc produced.
[2/] No production reported for years omitted from table.
[3/] Combined lode and placer production.
[4/] County production breakdown by districts not available.

TABLE 9. - Mine production of gold and silver[1] in the Emigrant mining district, Park County, Mont., 1901-1947, in terms of recovered metals

Year[2]	Tons ore sold or treated	Gold, ounces			Silver[4] fine ounces	Total value
		Lode	Placer	Total		
1901	1,000	250	-	250	300	$5,351
1902	100	100	-	100	-	2,067
1903	220	45	-	45	-	930
1905	-	-	229	229	34	4,751
1906	-	-	18	18	3	368
1907	-	-	45	45	8	928
1908	-	-	26	26	2	535
1909	-	-	1	1	-	21
1910	-	-	63	63	11	1,299
1911-1915[3]	-	-	-	-	-	-
1916	-	-	26	26	3	540
1917[3]	-	-	-	-	-	-
1918	-	-	28	28	4	579
1919	-	-	67	67	6	1,392
1920[3]	-	-	-	-	-	-
1921	-	-	45	45	7	935
1922	-	-	18	18	3	370
1923	-	-	2	2	-	41
1924	-	-	3	3	-	62
1925	-	-	1	1	-	21
1927	-	-	5	5	1	104
1930	-	-	21	21	4	437
1931	-	-	47	47	8	963
1932	-	-	300	300	46	6,209
1933	-	-	414	414	63	8,586
1934	-	-	796	796	130	27,908
1935	-	-	758	758	128	26,614
1936	-	-	308	308	40	10,825
1937	-	-	167	167	22	5,862
1938	-	-	213	213	17	7,466
1939	-	-	196	196	28	6,879
1940	-	-	442	442	76	15,524
1941	-	-	2,188	2,188	308	76,799
1942	-	-	4,352	4,352	623	152,763
1943	-	-	12	12	-	420
1944	-	-	6	6	-	210
1945	-	-	3	3	-	105
1946	-	-	2,875	2,875	422	100,966
1947	-	-	1,917	1,917	295	67,362
Total	1,320	395	15,592	15,987	2,592	$536,192

[1] No copper, lead, or zinc produced.
[2] No production reported for years omitted from table.
[3] Breakdown of county production by districts not available.
[4] Combined lode and placer production.

TABLE 10. - Mine production of gold, silver, copper, and lead1/ in other districts in Park County, Mont., 1901-1947, in terms of recovered metals

District	Year2/	Tons ore sold or treated	Gold, ounces			Silver3/ fine ounces	Copper pounds	Lead pounds	Total value
			Lode	Placer	Total				
Cowles-Independence........	1930	-	-	5	5	2	-	-	$106
Do.	1931	-	-	4	4	-	-	-	83
Do.	1932	-	-	2	2	-	-	-	42
Do.	1933	-	-	4	4	-	-	-	82
Do.	1934	-	-	4	4	-	-	-	144
Do.	1936	-	-	2	2	-	-	-	56
Do.	1938	-	-	3	3	-	-	-	105
Do.	1941	-	-	2	2	-	-	-	70
Total............................		-	-	26	26	2	-	-	688
Natural Bridge..............	1901	200	20	-	20	8	-	-	420
Do.	1902	1,000	161	-	161	112	-	-	3,384
Total............................		1,200	181	-	181	120	-	-	3,804
Yellowstone River..........	1933	-	-	7	7	-	-	-	146
Do.	1934	-	-	34	34	3	-	-	1,184
Do.	1935	-	-	72	72	11	-	-	2,515
Do.	1936	-	-	3	3	-	-	-	105
Do.	1937	-	-	68	68	13	-	-	2,390
Do.	1939	-	-	15	15	-	-	-	525
Total............................		-	-	199	199	27	-	-	6,865
Mill Creek................	1946	5	1	-	1	323	200	200	350
Basin Creek...............	1947	-	-	1	1	-	-	-	35

1/ No zinc production recorded.
2/ No production reported for years omitted from table.
3/ Combined lode and placer production.

TABLE 11. - Summary of lode production, 1901-1947, Park County, Mont.

	Jardine district	New World district	Crevasse district	Other[1/] districts	Total all districts
Gold:					
Ounces produced	171,408	36,856	2,770	577	211,611
Ounces per ton ore	0.185	0.191	0.207	0.245	0.186
Silver:					
Ounces produced	32,262	380,086	700	743	414,791
Ounces per ton ore	0.04	1.97	0.05	0.32	0.36
Copper:					
Pounds produced	4,368	1,653,283	-	200	1,657,851
Pounds per ton ore	-	8.57	-	-	1.46
Lead:					
Pounds produced	1,292	2,507,614	-	200	2,509,106
Pounds per ton ore	-	13	-	-	2.21
Zinc:					
Pounds produced	-	920,200	-	-	920,200
Pounds per ton ore	-	4.77	-	-	0.81
Ore mined, tons	925,959	192,916	13,357	2,350	1,134,582
Average value per ton, dollars	5.38	10.88	5.18	5.32	6.31
Total value, dollars	4,979,017	2,099,097	69,217	12,502	7,159,833

1/ Emigrant, Natural Bridge, and Mill Creek districts.

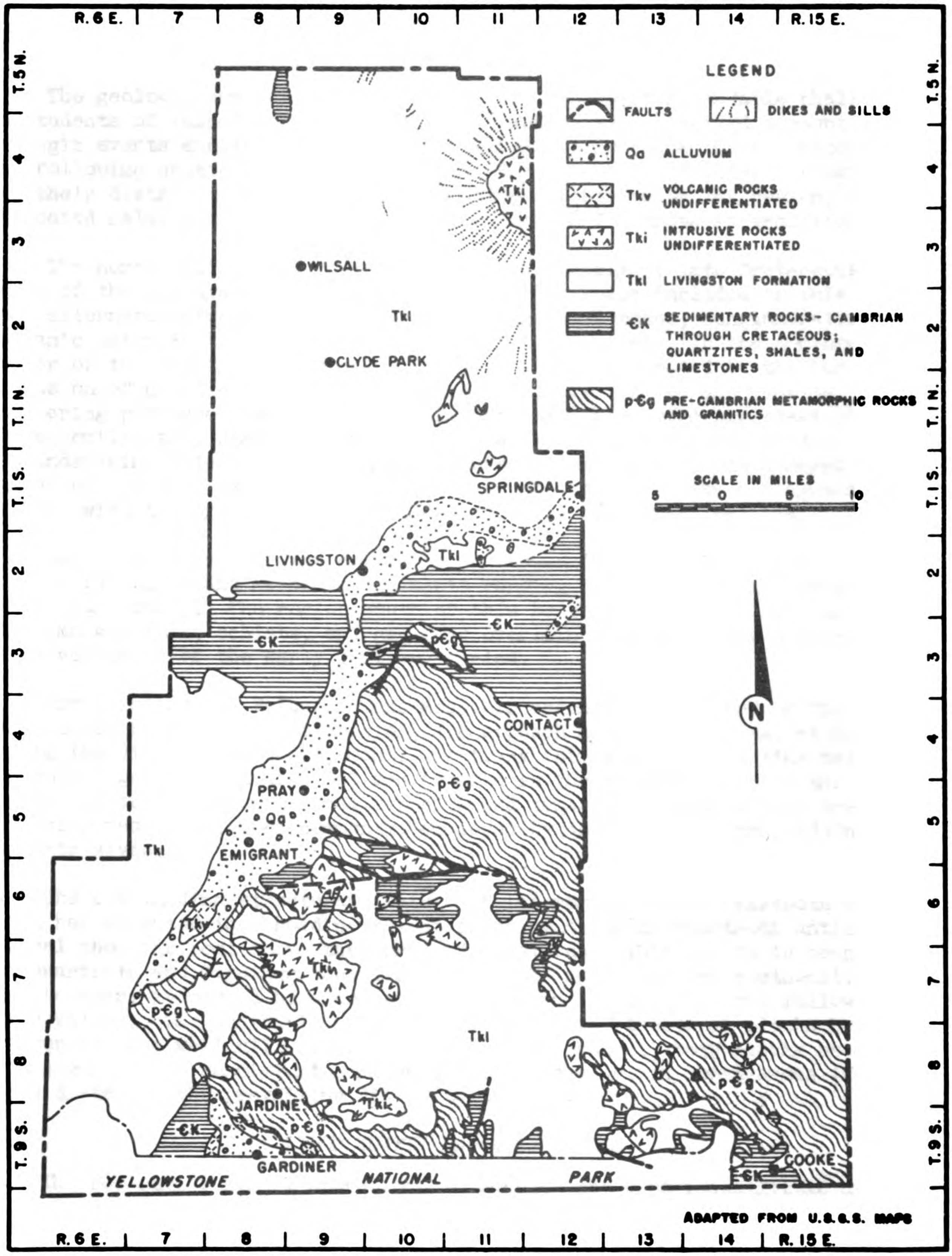

Figure 2. - Generalized geologic map of Park County, Mont.

GEOLOGY, GENERAL

The geologic complexities of Park County present a formidable challenge to students of vulcanism and tectonics. Inasmuch as a detailed account of geologic events and their significance is beyond the scope of this report, the following section is limited to a brief mention of the general rock units and their distribution, the broader structural features of the region, and the indicated relationship between these features and the known mineralized areas.

The north half of the county is overlain largely by late Cretaceous sediments of the Livingston formation (fig. 2). The rocks included in this formation alternate between shales, coarse and fine sandstones, conglomerates, and volcanic material to a maximum thickness of 12,000 feet. In the northeast corner of the county the formation has been highly indurated by the local intrusion of countless sills, dikes, and stocks of diorite and granite. Weathering processes have only slightly affected these more resistant rocks. Consequently, they stand in marked relief above the surrounding plains, which are underlain by the softer, unmetamorphosed sediments (1). No mineral occurrences of economic value have been found in the county in the Livingston formation, with the exception of scattered deposits of optical calcite.

The central part of the county is traversed from west to east by a narrow belt of Paleozoic and Mesozoic sediments ranging from Cambrian to the middle Cretaceous epochs. The region south of this belt is occupied mainly by pre-Cambrian granites, schists, and gneisses overlain in part by andesite and other volcanics of the early Tertiary period.

Small islands of Paleozoic and Mesozoic sediments, stripped of their volcanic cover by faulting and erosion, are exposed along Mill Creek, at Gardiner, and in the vicinity of Cooke, Mont. Tertiary intrusives, consisting mainly of monzonite, gabbro, and diorite, are exposed in the southern part of the county. Nearly all of the known mineral deposits and mines are either within these intrusive masses or, more commonly, enclosed by sedimentary rocks adjoining the intrusives.

The outstanding structural feature of the region is the Beartooth uplift, which has elevated the broad northwest-trending Absaroka-Beartooth anticline several thousand feet above the surrounding plains. This uplift is bounded by the Beartooth and Gardiner thrust faults on the northeast and southwest. Its west boundary is marked by a down-faulted segment occupied by the Yellowstone River Valley. The uplift is sharply divided in two structural blocks by the pronounced east-west Mill Creek fault zone. In general, both blocks usually have a gentle but persistent northward tilt. However, in local areas (New World district) the prevailing dip is to the south.

LABOR SUPPLY AND WAGE SCALES

The few active mining operations in Park County experience little difficulty in maintaining adequate labor forces. Experienced mine labor for new or expanding operations probably could be easily recruited from the Butte and Tobacco Root regions.

Mine and mill labor at both the Jardine and New World districts are union-affiliated. Wage scales in effect November 1948 were closely patterned after, although slightly lower than, the prevailing Butte scale. Wages paid at some of the larger Park County mining operations, as compared with the Butte scale, are as follow:

Labor-class	Hourly rate 1/	
	Park County	Butte District
Unskilled surface	$1.10-1.15	$1.32
Miners	1.15-1.25	2/ 1.39
Millmen	1.10-1.25	1.42
Truck drivers	1.14	1.40-1.46
Shovel and dozer operators	1.25	-

1/ Based on 40-hour week.
2/ Base pay for contract miners.

Small mine operators often resort to leasing or contract systems to avoid established payroll deductions and the incurred accounting expenses. These deductions, ranging from 11 to 13 percent of the total payroll, are as follows:

Item	Deduction, percent	
Old age and survivorship insurance		1.0
Federal-State unemployment compensation		3.0
State industrial accident insurance: 1/		
Underground workers	10.0	
General, surface labor and truck drivers	6.25	
Millmen	3.50	
Average State industrial accident insurance		8.0
Total		12.00

1/ No provision made for decreasing premium rates for operators having favorable experience records.

MATERIALS AND SUPPLIES

Tremendously increased mine equipment and supply costs contribute strongly to conditions that currently tend to retard the exploration and development of new mineral deposits as well as threaten idleness to established marginal operations. Further, many items of equipment are difficult to obtain even at advanced prices. Fabricated iron and steel products usually maintained in adequate stocks at most mining supply points now require extended periods for delivery.

Current costs of a few commonly used supplies are given in illustration of the general upward price trend. The following prices are quoted f.o.b. Butte, Mont., unless otherwise indicated.

Item	Price
Bits, center hole, lots of 500-2,500, each:	
1-5/8 inch	$ 0.36
1-3/4 inch	.37
1-7/8 inch	.38
2-inch	.39

Item	Price
Explosives:	
No. 6 blasting caps (lots less than 5,000), per M.	$20.60
No. 6 electric blasting caps (lots less than 5,000), per C	14.15
Powder, in ton lots, cwt.	18.00 - 21.75
Fuse (in 3,000-foot lots), per M feet	12.35
Pipe, black iron, 21-foot lengths; per cwt.:	
1-inch	$14.25
2-inch	30.37
3-inch	62.33
Mine rail, per cwt.:	
16-pound	7.65
25-pound	7.40
40-pound	7.40
Timber:	
Stulls, per 1,000 bd. ft.[1]	$29.50
Diesel fuel, per gal.:[2]	
Cooke, Mont.	$ 0.175
Emigrant, Mont.	.158
Gardiner, Mont.	.158
Jardine, Mont.	.158

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[1] Delivered at Rocker, Mont.

[2] Indicated prices apply to deliveries within 25 miles of the bulk plants.

POWER

Electric energy for both industrial and domestic consumption is supplied to Park County by transmission lines of the Montana Power Co. The main power artery enters the county from Bozeman at the west and runs eastward to Livingston, where it follows along the Yellowstone River to the east county boundary at Springdale. This line has a capacity of 7,000 kilowatts at a nominal operating value of 50,000 volts.

The only branch from the main artery runs southward from the Livingston substation up the Yellowstone River Valley to Gardiner and terminates at an interconnection with the privately owned hydroelectric plant just below Jardine. This branch has a nominal operating value of 50,000 volts and a rated capacity of 5,000 kilowatts.

Charges made for industrial energy supplied by the Montana Power Co. throughout the State are given in the following schedule, which is based on a sliding scale for actual kilowatt-hour consumption plus a charge based on peak demand:

TABLE 12. - Montana Power Co. Schedule GS-44, power rates

	Rate per kw.-hr.
First 12 or less	$0.75
Next 288	.035
Next 1,500	.025
Next 3,200	.015
Next 15,000	.009
Next 200 kw. of demand	.007
All additional kw.-hr.	.005
Plus demand charge:	
First 10 kw.	No charge.
Next 20	$0.95
All additional	.75

The existing mine load on Montana Power Co. circuits in the county is essentially insignificant. The only present outlet is at the Jardine hydroelectric plant interconnection, where Montana Power Co. energy is available on a standby basis.

Although the Jardine Mining Co. normally generates an adequate electric-energy supply for mining and milling operations, their plant is subject to periodic failures in winter because of icing and consequent reduction of stream flow. Under present arrangements the domestic load at Jardine is carried entirely by the Montana Power Co. Energy is generated at Jardine by a Pelton wheel operating at 365 p.s.i. and driving a 750 kv.-a. General Electric generator.

Generating equipment at the concentrator of the McLaren Gold Mines Co. at Cooke, Mont., consists of two 170 kv.-a. generators driven by 4-cycle, Fairbanks-Morse, 100-horsepower oil engines and one 231 kv.-a generator driven by an Ingersoll-Rand Diesel engine of 273 brake horsepower.

The Parkmont Mining Co., Cooke, Mont., operates its mill with energy supplied by a 225 kv.-a. alternator driven by a 260-horsepower, General Motors, tank twin Diesel engine.

The total rated capacity of privately operated electric generating equipment supplying energy to mining operations within Park County is shown in table 13.

TABLE 13. - Installed generating capacity at mining operations in Park County, Mont.

Mine	Type of generating plant	Voltage supplied	Cycles	Rated capacity, kv.-a.
Jardine Mining Co.	Hydroelectric	4,400	60	750
McLaren Gold Mines Co.	Diesel	480	60	571
Parkmont Mining Co.	Diesel	220	60	225
Total				1,546

TRUCKING COSTS

The main factors determining trucking charges from mine to mill or shipping point are mine altitude, difference in elevation between points of origin and destination, loading and unloading facilities, and road conditions.

The few currently active properties in Park County restrict haulage to the late spring, summer, and fall, thereby avoiding the high cost of winter road maintenance. At two high-altitude open-cut operations mining is suspended during the late fall and winter. However, by stock-piling during favorable haulage periods, milling operations are enabled to continue the year around. Although this method is well-adapted to unfavorable climatic conditions, it requires that a substantial capital outlay be tied up in stock pile plus additional charges for secondary loading and hauling to mill bins.

Trucking costs on ores and concentrates at properties operating in 1948 are given in the following table. Although these examples represent a diversity of conditions, their number is too few to permit generalization.

Mine	Elevation, ft.	Destination	Elevation, ft.	Distance, ft.	Cost/ton	Cost/ton mile
Travertine[1]..	6,000	Gardiner	5,270	2.5	[2] $1.47	$0.588
Parkmont......	9,700	Mill plant	8,550	3.0	[2] 0.50	.166
McLaren.......	9,600	do.	7,650	4.7	[3] .38	.081
Barbara Ann...	8,100	Livingston	4,490	38.4	[2] 4.00	.104
Irma[4]........	8,200	Gardiner	5,270	58.0	[2] 5.00	.086

[1] Product: dimension stone handled in individual blocks of several tons each.
[2] Contract charge.
[3] Direct operating cost.
[4] Concentrates.

RAILROAD FREIGHT RATES

Freight rates in effect October 1948 on ores and concentrates from selected Northern Pacific Railroad shipping points in and near Park County, Mont., to the three Montana smelters, per ton in 30-ton minimum carload lots, were as follows:

Value per ton, not exceeding....	$15	$25	$35	$50	$100	Over $100[1]
To A.S. & R. Co. smelter, East Helena, Mont., from:						
Gardiner......................	$3.65	4.10	4.63	5.17	5.33	-
Emigrant......................	3.17	3.58	4.27	4.81	5.17	-
Livingston....................	2.69	3.02	3.38	3.94	4.27	-
Wilsall.......................	3.32	3.74	4.27	4.99	5.17	-
Big Timber, Sweet Grass County	3.17	3.58	4.27	4.81	5.17	-
Bozeman, Gallatin County......	2.38	2.68	3.02	3.74	3.94	-

Value per ton, not exceeding....	$15	$25	$35	$50	$100	Over $100[1]
To Washoe sampler, A.C.M. Co., Butte, Mont., from:						
Gardiner........................	$3.65	4.10	4.63	5.17	5.53	-
Emigrant........................	3.17	3.58	4.27	4.81	5.17	-
Livingston......................	2.69	3.02	3.38	3.94	4.27	-
Wilsall.........................	3.32	3.74	4.27	4.99	5.17	-
Big Timber......................	3.17	3.58	4.27	4.81	5.17	-
Bozeman.........................	2.38	2.68	3.02	3.74	3.94	-
To A.C.M. Co. zinc plant, Great Falls, Mont., from:						
Gardiner........................	6.03	6.78	7.65	8.91	9.47	-
Emigrant........................	5.55	6.26	7.29	8.55	9.11	-
Livingston......................	5.07	5.70	6.40	7.68	8.21	-
Wilsall.........................	5.70	6.42	7.29	7.73	9.11	-
Big Timber......................	5.55	6.26	7.29	8.55	9.11	-
Bozeman.........................	4.76	5.36	6.04	7.48	7.88	-

[1] For each $50 a ton (or fraction thereof) increase in value above $100 a ton, add 20 percent to the rates provided herein for ores and concentrates of value of $100 a ton.

Freight rates between the above-listed shipping points and smelters in Idaho and Utah are not available. Rates may be established in specific instances, however, on application to the traffic agent of the railroad concerned.

SMELTER SCHEDULES

Most of the western custom milling plants and smelters find it impossible to quote blanket or "open" schedules for purchases of ores and concentrates. Applicable schedules usually are established only after analyses have been made of representative samples submitted by the prospective shipper. In many instances favorable schedules are negotiated and based on contractual tonnage agreements between seller and buyer.

The following are summarized schedules of those in effect October 1948. It is emphasized that these schedules are useful in preliminary calculations only.

East Helena smelter-American Smelting & Refining Co.
Copper-lead-gold-silver ores and concentrates

Payments for metals:

Gold-minimum paid for, 0.03 ounce per ton.

Ounces per ton	Per ounce
0.03 to 3.0....................................	$31.81825
Plus 3.0.......................................	32.31825

Silver-Pay for 95 percent at average of the Handy & Harman, New York quotations, or Mint price, less minimum deduction 1 troy ounce per dry ton.

Lead- If 3 percent or over by wet assay, deduct from wet assay 1.5 units (a unit is 20 pounds) and pay for 90 percent of the remaining lead at the average of the daily published A. S. & R. Co. quotations for common desilverized domestic lead for delivery in New York City, less 1.8 cents per pound of lead accounted for.

Copper-If 1 percent or over, deduct from wet copper assay 1 unit and pay for 100 percent of the remaining copper at daily net refinery quotations for electrolytic cathodes as published in E. & M. J. Metal & Mineral Markets of New York, less a deduction of 6 cents per pound of copper accounted for.

Deductions:

Base charge- $8 per net dry ton for treatment of ores and concentrates having a settlement lead content of 20 percent or less; deduct 10 cents per ton for each unit of lead over 20 percent, fractions in proportion; $7 per ton for those having no payable lead content.

Arsenic and antimony (combined)- 2 percent free; excess charged at 50 cents per unit, fractions in proportion. 0.1 percent of lead content by wet assay allowed free; excess charged at 50 cents per pound.

Zinc- 10 percent free; excess charged at 30 cents per unit, fractions in proportion.

Sampling and assaying- Charge $10 per lot when less than $200 value and $20 per lot when over $200 value for shipments of less than 5 tons dry weight. Charge $5 per lot when less than $200 value and $10 per lot when over $200 value for shipments less than 10 tons dry weight.

Washoe Sampler-Anaconda Copper Mining Co., Butte, Mont., copper, gold, and silver ores and concentrates

Payments for metals:

Copper-96 percent of copper content, with minimum deduction of 10 pounds per ton, at E. & M. J. average price of electrolytic copper for week ending Wednesday preceding date of sampling, less 2.5 cents per pound.

Silver-95 percent of silver content, with minimum deduction of 1 ounce per ton at Government price less 2 cents per ounce. Silver not eligible for Government price will be paid for at open-market quotation, as quoted by E. & M. J.

Gold- 95 percent of gold content, with minimum deduction of 0.01 ounce per ton, at $20 per ounce, plus 90 percent of premium in excess of $20.67 per ounce. (This is equivalent to paying for 100 percent at $31.81825 per ounce.)

Treatment charge, f.o.b. Washoe sampler, Butte, Mont.:

Base charge - $4 per ton.
Add 10 percent of sum of metal payments in excess of $15 per dry ton.
Add 12 cents for each 1 percent iron (Fe).
Deduct 2.5 cents for each 1 percent of silica (SiO_2) in excess of alumina (Al_2O_3).
Maximum total treatment charge to be $5.50 per dry ton.

In case company elects to have shipments made direct to the smelter at Anaconda for sampling, the base treatment charge will be $3.75 per dry ton, f.o.b., Anaconda Reduction Works, Anaconda, Mont., with maximum total treatment charge of $5.25 per dry ton. Lots of less than 10 tons will be assessed an extra sampling charge of $5 flat on each lot.

Electrolytic zinc plants, Anaconda Copper Mining Co., at Anaconda and Great Falls, Mont., zinc concentrates

The Anaconda Copper Mining Co. does not quote open schedules for the treatment of zinc ores or concentrates at its Anaconda or Great Falls plants. Owing to impurities, which complicate treatment in these plants, only certain types of concentrates are accepted. A prospective shipper is offered terms of purchase only after the suitability of the concentrates involved is determined by complete analysis of a representative sample.

Terms of purchase for zinc concentrates accepted by these plants are given in the following schedule covering specific shipments made by one operator during 1948.

Payments for metals in zinc concentrates:

Zinc............	Eighty percent (80%) of zinc content at St. Louis price for prime western zinc.
Lead............	Eighty percent (80%) of lead content in excess of 3 percent, at New York price, less 2 cents per pound.
Silver..........	Eighty percent (80%) if 1.0 ounce per ton or over.
Gold............	One hundred percent (100%) if 0.01 ounce per ton or over, at $27.024 per ounce.

Other metals.... No payment shall be made for any other metal or metals contained in concentrates, and such metals shall be the property of the Anaconda Co.

Prices for zinc and lead shall be those quoted by Engineering & Mining Journal for week of arrival of concentrates at plants of Anaconda.

Treatment charge:

Base treatment charge shall be thirty dollars ($30.00) per dry ton of concentrates delivered and accepted, based on St. Louis price of prime western zinc of ten and one-half cents (10-1/2¢) per pound; a cost of labor in the zinc plants of the Anaconda Copper Mining Co. at Anaconda and Great Falls, Mont., based at $11.40 per 8-hour day with the addition to or subtraction from said base treatment charge per dry ton of concentrates of one cent (1.0¢) for each one cent (1.0¢) increase or decrease in said cost of 8-hour day employment; a lead content of three percent (3%); and arsenic plus antimony content of 0.125 percent.

There shall be added to, or subtracted from, said base treatment charge one dollar ($1.00) per dry ton of concentrates for each one cent (1.0¢) per pound increase or decrease in the price of prime western zinc at St. Louis above or below ten and one-half (10-1/2¢) per pound, fractions proportionately. Fifty cents (50¢) per dry ton of concentrates shall be added to said treatment charge for each one percent (1%) lead below three percent (3%) in such concentrates, fractions in proportion. Twenty-five cents (25¢) per dry ton of concentrates shall be added for each one percent (1%) of insoluble material plus iron. Twenty cents (20¢) per dry ton of concentrates shall be added for each 0.10 percent arsenic plus antimony in excess of 0.125 percent.

METALLIC MINES AND MINERAL OCCURRENCES

Most of the recognized mining districts are liberally dotted with shallow prospect openings. Although many of these openings were inspected, it is obvious that their inclusive detailed examination was impossible under the scheduled program of field investigations. Insofar as possible, all known mines and mineral occurrences of inventory value are indicated on the county map and in the mineral tables appended to this report. However, no inference concerning the merits of a specific property or prospect should be attached to its omission from discussion in the following sections.

In 1947-1948 mining activities in Park County were limited to six small and medium-scaled operations, three of which were in the initial stages of development and exploration. In spite of the relative inactivity during this period, county mineral production attained its highest value since the beginning of the statistical record in 1887.

Jardine District

Location and access. - The Jardine mining camp is 6 miles northeast of Gardiner, Mont., by a graveled and maintained county road. It is entirely within the boundary of the Absaroka National Forest. Gardiner (population 750) is on U. S. Highway 89 at the north entrance of Yellowstone Park. It is served by a branch of the Northern Pacific Railroad, which follows the Yellowstone River Valley to join the main transcontinental line at Livingston, Mont., 56 miles to the north. Winter road maintenance makes year-round travel possible between Jardine and Gardiner.

Topography. - The Jardine district embraces an area of about 9 square miles in the rugged uplands at the south end of the Snowy Range. This area is marked by precipitous slopes that culminate in both flat-topped and broadly rounded crests. The region's perennial streams and tributary drains are confined to narrow channels whose steep walls often rise without apparent break for 900 to 1,800 feet.

The district is drained by Bear Creek and its tributaries, Pole Creek, North Fork, and Pine Creek. Bear Creek flows southward through an increasingly deep and steep-walled gorge, finally entering the Yellowstone River about a mile east of Gardiner.

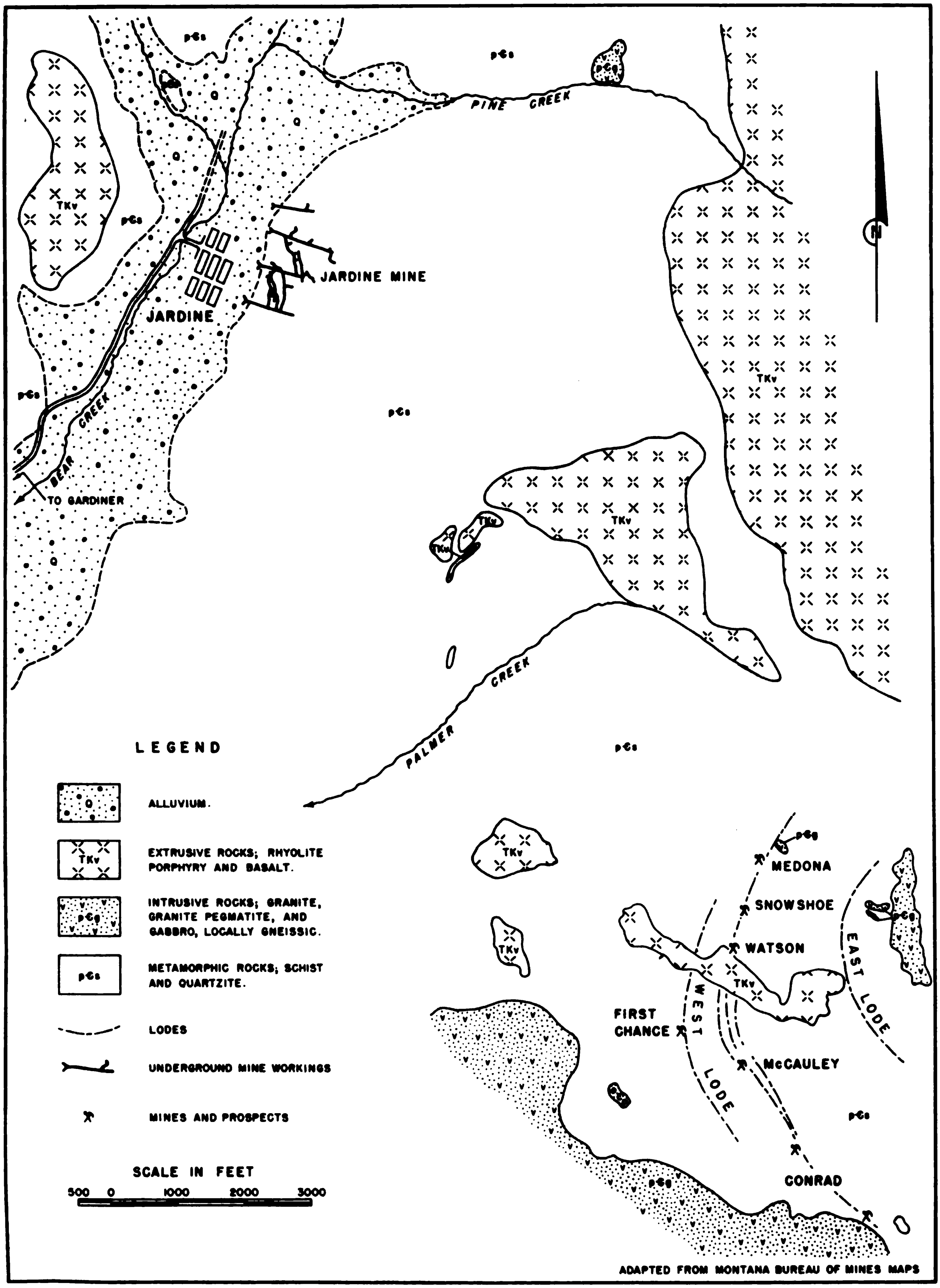
Forestation. - The lower southern and western parts of the district are largely untimbered with the exception of scattered stands of deciduous growth flanking drains and stream channels. These untimbered areas are well-covered by sage, buck brush, and abundant range grasses. In contrast, the higher northern and eastern reaches of the district are heavily forested with dense stands of mature lodgepole pine, fir, and spruce. All of the district's timber requirements for mine support and general construction are supplied by these forests.

Water supply. - The area is bountifully supplied with water for both industrial and domestic use. The mean minimum flow of Bear Creek is estimated at about 10,000 g.p.m. In addition to supplying all metallurgical demands, it affords a dependable source of energy for the hydroelectric plant installed in Bear Canyon below Jardine. The camp's domestic water requirements are supplied by flume from Pine Creek, to the northeast.

Geologic setting. - The rocks exposed in the Jardine district range from pre-Cambrian to Quaternary and embrace sedimentary, metamorphic, intrusive, and volcanic types (fig. 3).

The known mineral lodes are confined to the pre-Cambrian metamorphic series. This series has been divided (2) into the following petrographic types:

Biotite quartzite
Quartz-biotite schist
Quartz-cummingtonite-hornblende schist



ADAPTED FROM MONTANA BUREAU OF MINES MAPS

Figure 3. - Geologic map of the Jardine-Crevasse area, Park County, Mont.

Biotite quartzite and quartz-biotite schist together comprise by far the greater part of the exposed pre-Cambrian series. However, these types are of secondary economic importance to quartz-cummingtonite schist as hosts for consistently productive ore bodies.

The intrusive rocks have been assigned to the pre-Cambrian largely on the basis of linear structures developed by regional metamorphism (2). These rocks, in order of presumed increasing age, are granite and related aplites and pegmatites, gabbro, and diabase. The numerous outcrops of diabase and gabbro occur most commonly as sills conformable to schistosity (bedding), small stocks, and dikes of limited size and extent. Thereis no recognized genetic relationship between these rocks and the mineral lodes.

Small masses of pre-Cambrian granite found near the south margin of the district are evidently outliers of a large granitic body to the southeast. At some of the schist-granite contacts, dikes and sills of aplite and granitic pegmatite grade into auriferous quartz veins, suggesting a genetic relationship between the mineral lodes and the granite.

It is estimated that Tertiary and Quaternary volcanics blanket about 15 percent of the Jardine area. These rocks are largely rhyolite and tuff with minor basalt.

Bedding of the original sediments has been determined to parallel closely the foliation planes later developed in the pre-Cambrian schist series. Although these schists are highly contorted in detail, several of their broader structural relationships have been determined.

The rocks enclosing the Jardine lodes have been crumpled into a small, northward-trending, anticlinal structure. In general, dips on the west limb of this fold range from 20° to 80° W., although, locally, individual beds may flatten and even reverse direction. A westward-dipping normal fault has depressed the east limb and its enclosed veins about 300 feet (2). This fault strikes nearly parallel to the axial plane of the anticline and dips about 40° W. It appears to be related to an assumed major fault zone that marks the course of Bear Creek.

The presence of well-developed and persistent cross folds suggests that the direction of dominant pressure was rotated about 90 , thereby preparing openings favorable for lode emplacement. Forces later relieved in the Gardiner thrust fault to the south may have been largely responsible for both the development of these cross folds and the initial vein openings.

The known lodes of the Jardine district are in both the west limb and at or near the crest of a small anticline. These lodes strike northerly over a known distance of 3,000 feet and range from 10 to 80 feet or more in width.

The several veins comprising these lodes are generally concordant to the enclosing schists; they dip westward and closely follow the tight and often reversed folding developed in the metamorphic series. A few vein structures of minor economic importance occupy pre-mineral fractures, which usually crosscut the foliation at low angles.

At least six major veins and their numerous splits have been recognized in the development of the Jardine lodes. They are irregularly spaced within the lodes over widths of 3 to 15 feet. Individually, the veins range from several inches up to 15 feet in width, are lenticular in habit, and in plan present an en echelon pattern. In some instances the veins display a marked pipelike structure. These various structural complexities greatly hinder systematic development and extraction of the ore bodies.

The two vein types recognized in the district are distinguished by dominant mineralogical composition and character of enclosing rocks. Quartz veins in biotite quartzite and quartz-biotite schist occur with considerable frequency in the lodes of the district. These veins are characterized by lenses and pods of quartz containing gold, scheelite, arsenopyrite, pyrite, and galena usually concentrated near the schist-quartz margins. Veins of this class are typically erratic in metal content and vary from barren glassy quartz to bonanza grade.

Arsenopyrite veins in quartz-cummingtonite schist comprise the second recognized vein type. These veins are characterized by either uniformly distributed quartz and sulfides (arsenopyrite and pyrite) within cummingtonite or sulfide-rich veins in cummingtonite accompanied by quartz lenses. Although tungsten is essentially absent from these veins, their gold content is relatively consistent and of higher tenor.

The primary minerals of the Jardine veins are listed in order of paragenetic sequence (2) in table 14. The minerals of economic importance are capitalized.

TABLE 14. - Paragenetic sequence in the Jardine vein minerals

1. Quartz
2. Feldspar
3. Cummingtonite
4. Hornblende
5. Biotite
6. Garnet
7. ARSENOPYRITE
8. SCHEELITE
9. Pyrite
10. Pyrrhotite
11. Chalcopyrite
12. Sphalerite
13. Galena
14. Chlorite
15. GOLD
16. Siderite
17. Calcite

The Jardine lodes have been explored and developed by more than 30 adits and about 7 miles of underground workings (fig. 4). In 1948, six main haulage adits and numerous intermediate levels were either in use or accessible to inspection. Although many of the older stopes and drifts were caved, the ground stands exceptionally well over wide spans. In the past, production was confined entirely to underground workings although increasing amounts of ore have been extracted from open cuts. To date, four open cuts have been almost completely mined out. Recent explorations have determined several additional open-cut sites.

The measurement and classification of the Jardine ore reserves is almost impossible because of both the structural complexities of the deposit and the

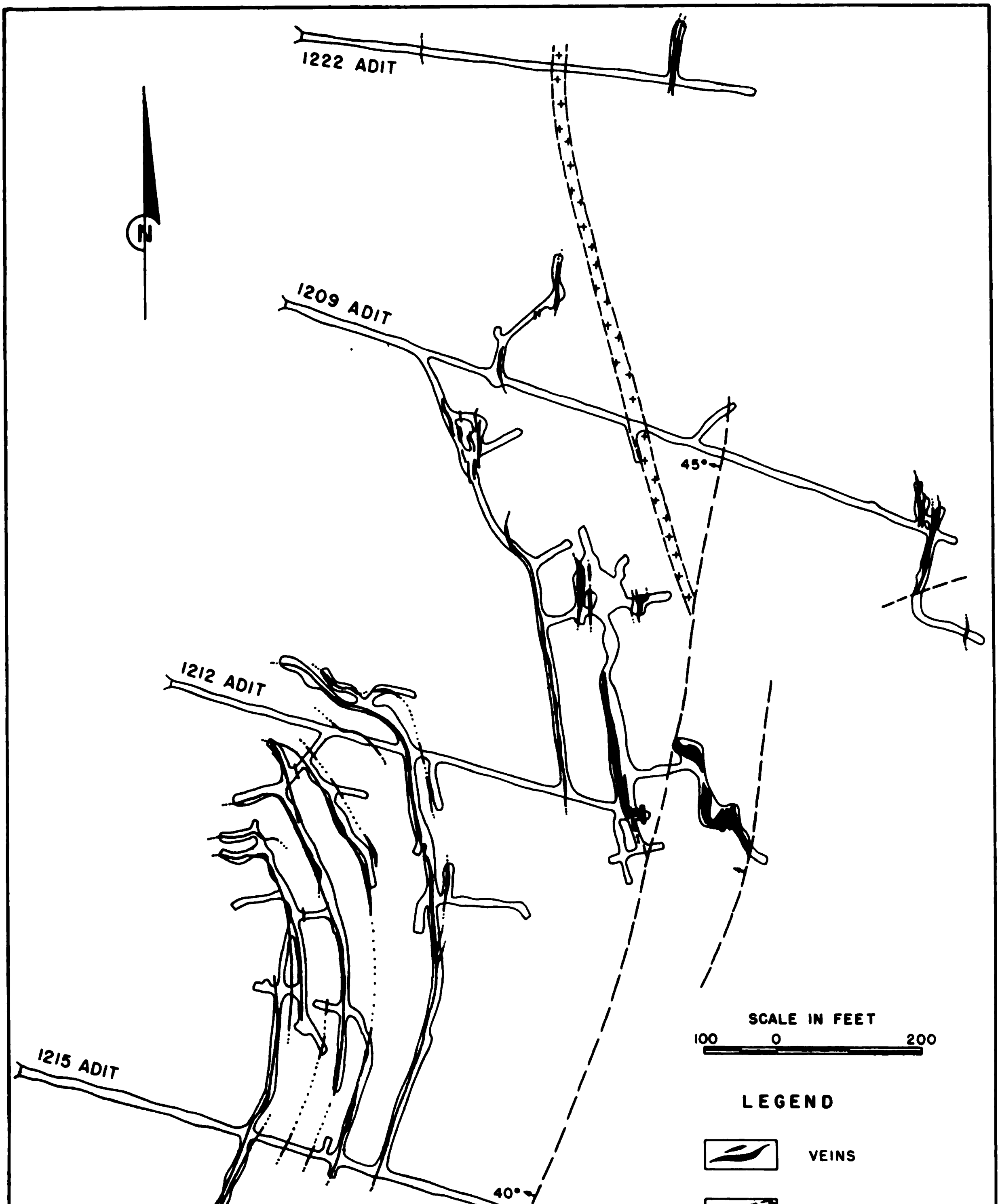


Figure 4. - Vein system and underground workings, 1200 level, Jardine mine, Park County, Mont.

erratic distribution of values within the veins. Available evidence suggests that the measured and indicated reserves would total not less than 350,000 tons. The inferred reserves would constitute an unknown but very large addition.

In tenor, these reserves may safely be assumed to equal that of current production which ranges between 0.10 and 0.20 ounce gold a ton. In the period 1932-1947, about 634,000 tons of ore averaging 0.157 ounce gold was mined and milled.

In addition to gold, the Jardine ores contain an average of 1 to 2 percent arsenic and from a trace to 0.1 percent tungsten. Recoveries of both metals have been attempted more or less successfully in the past. The currently depressed price of arsenic trioxide and the absence of markets have made the recovery and refining of this substance unprofitable. Metallurgical problems remain to be solved before the tungsten can be recovered economically.

The Jardine Mine (Au, As, W)

The Jardine Mining Co., 44 Wall Street, New York City, N. Y., and Jardine, Mont., owns 27 patented and 16 unpatented lode and placer claims totaling 1,165 acres in secs. 4, 8, 9, 16, 17, and 19, T. 9 S., R. 9 E., M.P.M., Park County, Mont. These holdings embrace the known lodes comprising the Jardine district.

The Jardine Mining Co. operation includes fully integrated facilities capable of extracting 400 tons of ore daily. At the normal production rate, 325 to 350 tons are mined in two 8-hour shifts from underground and open-cut workings. This ore is concentrated in a flotation mill having a designed capacity of 350 tons a day. The mill product is a gold-bearing arsenopyrite concentrate that is further treated by cyanidation. Gold was recovered from a battery of Merrill-Crowe precipitators and cast into bullion at the property. The cyanide plant was destroyed by fire in May 1948, which caused shutting down the entire operation. Company officials indicate that the plant may be rebuilt and operations resumed in the near future.

The operation is completely electrified by energy developed in a company-owned hydroelectric plant on Bear Creek. Timber cut from nearby government forests is contract-sawed and framed for mine use and general construction in a company-owned sawmill.

Crevasse Mountain District

The Crevasse Mountain district (fig. 3) is contiguous to the Jardine district on the southeast. Hence, to avoid repetition, discussions of topography, geologic setting, and other features common to both districts will be limited to the more significant deviations.

The district embraces an area of about 3 square miles on the southwest flank of Crevasse Mountain within the boundary of the Absaroka National Forest. It is 2-1/2 miles southeast of the Jardine camp by a steep truck trail that has occasional grades of 20 percent or more. Access by vehicle is possible only during the snow-free months. The area's timber supply is similar to that of the Jardine district. Its meager water resources have retarded exploitation of the district's mineral deposits to some degree.

Gold-bearing veins first were discovered at Crevasse Mountain in 1879 on ground later incorporated in the Conrad holdings. Exploitation of the Conrad deposits took place in 1891-1898 and 1904-1908. Other veins were prospected and partly developed at both the turn of the century and in recent years. These sporadic ventures, however, were only mildly successful and rarely continued beyond a 2-year period.

The Hulse group, one of the district's more active properties, was exploited under several managements during the periods 1921-1924 and 1934-1940. District activities have been entirely dormant since the shutdown of this property in 1940.

Several mills of various types were constructed in the district over the years. With the exception of the 20-stamp unit formerly at the Conrad property, these plants generally failed to produce satisfactory recoveries. It seems likely that the metallurgical difficulties experienced were aggravated further by the inadequacy of the water supply.

The rocks exposed in the Crevasse Mountain area are identical in type and sequence with those recognized at the Jardine. A pronounced feature of divergence between these districts is the proximity of the pre-Cambrian granite, which at Crevasse Mountain marks the southern limit of the metamorphic series and their enclosed lodes. Further, the lodes exposed at Crevasse Mountain appear to be entirely confined to the quartz-biotite schist member of the metamorphic series (2).

The schists at Crevasse apparently have been warped into a broad synclinal structure that pitches gently eastward. Consequently, the known lodes are disposed along two concentrically curved zones convex to the west. The lodes range from 1,300 feet to more than 6,000 feet in length and from 15 feet up to 800 feet in width. The east and west lodes are separated by an interval of apparently barren schists about 1,700 feet wide. The southernmost veins comprising these lodes strike about N. 30° W. and dip eastward at 40°. At the center of the district the veins strike northward and flatten somewhat in dip. Near their northern limit, they strike east of north and dip southeast at low angles.

The veins are predominantly characterized by a glassy quartz gangue, erratic distribution of gold, and the sporadic occurrence of scheelite. Sulfides other than arsenopyrite and pyrite are rarely found.

Essentially all of the underground workings of the Crevasse Mountain district are inaccessible because of either caving or flooding. Furthermore, the surface openings are debris-choked to a degree that makes bedrock examinations almost impossible. Consequently, the following descriptions of the mines and prospects are based largely on available reports and publications.

Conrad (Au)

The Conrad group, owned by the Conrad-Stanford Co., Helena, Mont., embraces six patented claims in the SE1/4 sec. 22, T. 9 S., R. 9 E. The property is at the south limit of the west lode.

The lode has been explored and partly developed on this property by a series of open cuts and underground workings over a strike length of 2,200 feet and a vertical range of 600 feet. Underground development is reported to total about 4,000 feet. The lode ranges from 10 to 40 feet or more in width, has an average strike of N. 35° W., and dips 25° to 45° E. (2).

The rocks enclosing the lode are quartz-biotite schist locally containing sericite, tourmaline, limonite, and arsenopyrite. Pre-Cambrian granite in contact with the schist marks the south limit of the lode. Pegmatitic tongues extending into the schists at this contact appear to be genetically related to the lode.

The numerous individual quartz lenses and stringers comprising the lode range from 6 inches to 6 feet in width. They are essentially concordant to the enclosing schists.

Pyrite and arsenopyrite are the only recognized sulfides. The gold, which is evidently closely associated with arsenopyrite, ranges up to 0.3 ounce a ton. The dominant gangue mineral is a glassy quartz which is locally granulated and iron-stained. In appearance it closely corresponds to the quartz of the veins in quartz-biotite schist at Jardine. Local concentrations of scheelite and galena, which characterize the Jardine veins, are evidently absent from the Conrad lode.

The Conrad incline was the only opening accessible in 1948. The lode, consisting of numerous quartz lenses and stringers, has been explored by this opening for a strike length of at least 230 feet and a width of about 45 feet.

The mine and mill plants are totally destroyed leaving no evidence of former operations except a few scattered open-cut scars and several waste dumps.

Dryden (Au)

The Dryden adit is in the SE1/4 of sec. 23, T. 9 S., R. 9 E., and near the south limit of the East lode. A series of narrow and discontinuous lenses of glassy quartz are exposed by this adit over a strike length of 300 feet. These lenses and the intervening quartz-biotite schist comprise a lode about 3 feet wide, which strikes N. 40° W. and dips about 30° E. (2).

The schists adjoining the quartz pods are chloritized, and some of them contain massive garnet. Although the quartz is lightly stained with limonite, no sulfides or sulfide relicts were observed.

First Chance (Lewis-McBride) (Au)

The footwall member of the West lode has been partly explored by about 1,500 feet of underground workings on the First Chance group. This property, which contains five patented claims in sec. 22, T. 9 S., R. 9 E., is owned by the McBride estate of Butte, Mont.

The workings expose a zone about 100 feet wide that strikes north and dips about 10° E. This zone contains five or more individual structures, each composed of numerous lenses and pods of glassy quartz lying parallel to the foliation of the enclosing quartz-biotite schist.

These quartz lenses range from several inches to 10 feet or more in width. They are characteristically shattered and filmed with limonite stains. Local concentrations of arsenopyrite, pyrite, and limonite in both the quartz lenses and the enclosing schist commonly contain the higher gold values. The schist adjoining the quartz lenses often is chloritized locally.

The accessible workings were searched for scheelite with the ultraviolet lamp with negative results. Several quartz fragments rich in scheelite were found in the mill bin and on the mine dumps.

A small gasoline-powered flotation mill constructed at the property in 1938 was operated for a short period without success. Consequently, the few small lots of ore produced from the property in 1939 were treated at Jardine. The mine and mill plants have been stripped of all equipment. The greater part of the underground workings was inaccessible in 1948.

McCauley (Au)

The McCauley group, owned by the Krieger estate, Lewistown, Mont., consists of two patented claims in the NE1/4 of sec. 22, T. 9 S., R. 9 E.

Several strands of the West lode, dipping eastward at 5° to 25°, strike across the property from north to south. It is reported that quartz stringers and lenses 1 to 3 feet thick are distributed along 4- to 5-foot zones of soft (chloritized) quartz-biotite schist.

The quartz lenses and enclosing schists are said to contain arsenopyrite, pyrite, and gold as well as minor amounts of scheelite and sphalerite (2).

The lode has been explored by a number of shallow adits and shafts as well as several small open cuts. All workings were inaccessible in 1948. No production is recorded for the property. However, a small quantity of scheelite is said to have been produced during World War I.

Medona (Au)

The Medona is a patented claim in the SE1/4 of sec. 15, T. 9 S., R. 9 E. owned by the Montana Vindicator Gold Mining Co., Miles City, Mont.

The adit workings partly explore a small segment of the north limb of the West lode that passes through the property at an average strike of N. 20° E. and a dip of 25° E. The enclosing rock is quartz-biotite schist with occasional local concentrations of chlorite and garnet (2).

A glassy quartz lens about 3 feet wide and several small footwall quartz stringers have been exposed by the underground development. The quartz and adjacent schist contain finely disseminated arsenopyrite and a small amount of gold. It has been reported that during World War I shceelite valued at $2,500 was extracted from a small pipe associated with the footwall quartz stringers. No evidence of tungsten minerals, however, was observed at the property.

The camp, consisting of several buildings and a small electrified mill plant, was abandoned in 1939. The buildings have been almost completely demolished by heavy snowfall. The 25-ton mill combining amalgamation and gravity concentration units was powered by a gasoline-driven generator. Although much of the plant equipment remained on the property in 1948 it has been made largely unusable by vandalism.

Snowshoe (Au, W)

The Snowshoe group consisting of 11 patented lode-mining claims, is owned by the Crevasse Mountain Mining Co., Butte, Mont. It is in secs. 15 and 22, T. 9 S., R. 9 E., on the north limb of the west lode. Access to the property is by 3-8/10 miles of steep, unimproved, truck trail southeast from Jardine, Mont.

The deposit, reportedly discovered in the 1880's was sporadically prospected and mined up to 1940. During the period 1934-1940, 6,000 tons of ore valued at $25,000 is reported to have been produced (table 8).

The property has been prospected and partly developed by three short crosscut adits, two shallow shafts, and a single open-cut. The underground workings, which total about 700 feet, were completely inaccessible in 1948. A large part of the Snowshoe's output is credited to the open-cut. This working is 30 to 90 feet wide and extends about 150 feet along the strike of the lode.

As exposed by the open-cut, the lode departs from its generally northeast trend to a strike of N. 10° to 55° W. and dips from 12° to 20° eastward. The lode consists of a series of quartz lenses and stringers enclosed in altered and garnetized quartz-biotite schist. It ranges from 1-1/2 to 10 feet in width; its average width is about 5 feet.

A preliminary examination of the underground workings made in 1942 indicated the presence of scheelite and traces of Hübnerite within both the altered schist of the lode and the adjacent country rock (3). A series of face samples was cut, composited, and assayed, with the following results:

WO_3, percent	Gold, ounce	Silver, ounce
0.55	0.08	0.05

Preliminary ore-dressing tests showed the material to be amenable to combined flotation and gravity concentration. The resulting low-grade concentrates however, would, require chemical treatment. These tests indicated that 96.1 percent of the tungsten and 85.6 percent of the gold were recoverable by flotation in a bulk concentrate containing 4.91 percent WO_3 and 4.9 ounces gold a ton. A concentrate containing 40.3 percent WO_3 at a recovery of 59.9 percent was produced by tabling the flotation product.

In 1948, a rough check on the deposit's tungsten content was attempted by pipe sampling the 6,000-ton tailing dam. The tailings were found to contain 0.04 percent WO_3 and 0.07 ounce gold a ton. This apparent discrepancy evidently confirms the belief that the greater part of the scheelite is confined to the adjacent wall rock entirely disassociated from the gold-bearing quartz lenses.

During the last period of operation (1934-1940), the ores were treated on the property in a 35-ton, gasoline-powered, amalgamation-flotation mill. The mill building now is in poor repair, and most of the equipment has been removed. Other improvements, consisting of a boarding house and shops, have been seriously damaged by neglect and heavy snowfall.

Watson (Au)

The Rio Grande and Crosscut unpatented claims in the NE1/4 of sec. 22, T. 9 S., R. 9 E., comprise the Watson group. The hanging-wall member of the West lode has been partly explored on the Crosscut claim by underground workings totaling about 400 feet.

The structure is enclosed in quartz-biotite schist. It ranges from 5 to 12 feet in width, strikes N. 12° E., and dips 5° to 25° E. Arsenopyrite and pyrite are localized within both the glassy quartz lenses at the quartz-schist contacts and the adjoining schist. The individual quartz lenses are 1 to 4 feet thick. They are reported to contain up to 0.3 ounce gold a ton and occasional traces of scheelite (2).

In 1948 the dumps were inspected under ultraviolet light with negative results. At that time the underground workings were inaccessible, and the camp buildings were largely demolished by heavy snows. The property was equipped with a 3-stamp, steam-powered mill. All milling and mining equipment has been destroyed or removed.

No production other than a single 800-pound shipment of scheelite made during World War I is credited to the property.

Other Prospects

Other prospects, including several patented claims and claim groups, are included in the Crevasse Mountain district. These are the Empire State, Frank, Kennebeck, Pop, and Vindicator. Descriptions of these properties have been omitted owing to the absence of pertinent factual data and their general inaccessibility.

New World District

Location and access. - The New World district is near the northeast corner of Yellowstone National Park near the boundary between Montana and Wyoming (fig. 1). The small settlement and tourist resort of Cooke, Mont., (Population 200) is in the southern part of the district. Cooke is 64 miles southwest of Red Lodge, Mont., (population 2,950) and 62 miles east of Gardiner by U. S. Highway 12. Connections with branch lines of the Northern

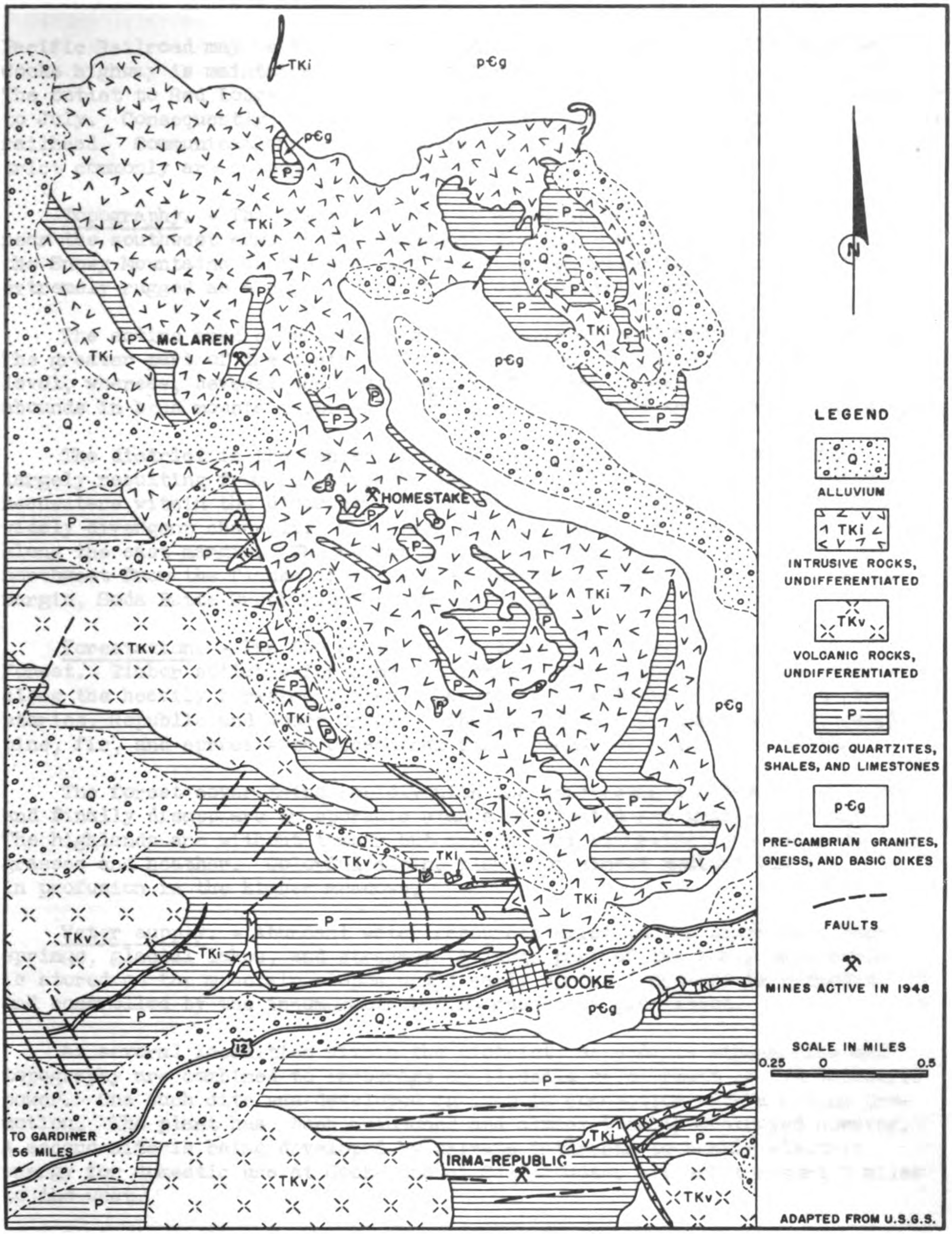


Figure 5. - Geologic map of the New World district, Park County, Mont.

Pacific Railroad may be made at both Red Lodge and Gardiner. The Gardiner-Cooke highway is maintained throughout the year by the National Park Service. The outlet to Red Lodge however, is, usually closed by heavy snow from November to July. Consequently, most freight movements proceed to and from the Gardiner railhead. Communications between Cooke and the interior of the New World district commonly are suspended by heavy snowfall from December to May.

Topography. - The district is in an elevated area of 23 square miles near the southwest edge of the Beartooth Plateau. This region is flanked by the Snowy Mountains on the west and the Absaroka Range to the south. It is extremely rugged as a consequence of profound glacial carving.

The entire area comprising the district is above 7,500 feet in altitude. The greater part of the district is between 9,000 and 10,000 feet above sea level, whereas, several peaks approach 11,000 feet in altitude. The region abounds in bold mountain spires, sheer precipices, and tremendous talus slopes.

The district is the center of an unusual radiating drainage pattern largely resulting from Pleistocene glaciation. Three main streams having headwaters within the district are tributary to the Yellowstone River through widely divergent channels. The Clark Fork of the Yellowstone flows southeast along the east margin. The headwaters of the Stillwater River flow to the northwest from the flanks of the divide marked by Daisy Pass. At the south margin, Soda Butte Creek flows westward through Cooke.

Forestation. - The New World district is within the Absaroka National Forest. Timber suitable for construction and mine support grows abundantly along the heavily forested slopes adjacent to Soda Butte Creek and its tributaries, Republic and Woody Creeks. The forests are predominantly lodgepole pine, fir, and spruce with occasional small stands of cedar and balsam.

The forest cover thins rapidly with the increasing altitudes to the north and finally disappears in sporadic stands of stunted and gnarled fir and cedar. The highlands are without timber but are in part blanketed with abundant grasses and heather. Colorful alpine plants of almost endless variety grow in profusion in the higher meadows.

Water supply. - Abundant water resources exist in the district's many springs, glacial lakes, and streams. A large part of the heavy snow cover is stored on the mountain slopes until early spring. Run-off is retarded and controlled by the innumerable basins caused by glaciation.

At several localities within the district, dependable stream flow and topography are combined to encourage small-scale development of hydroelectric power. One such site was developed in 1915 in connection with a mining promotion. The plant has been abandoned and almost totally destroyed however. A second site is being developed by private interests to supply electric energy for domestic use at Cooke and at Silver Gate, a tourist resort 3 miles to the west.

Geologic setting. - The rocks exposed in the New World district range from Archean crystallines to deposits of the Quaternary period (fig. 5).

Paleozoic sediments from the lower Cambrian through the Mississippian period have been identified. Mesozoic rocks, however, have been entirely removed from the region by erosion. Consequently, the succeeding Tertiary deposits have been laid on unconformable Paleozoic surfaces.

The predominant rocks of the Archean complex are distinguished (4) as follows:

Goose Creek granite. - A gray gneissic rock predominating in feldspar and quartz and containing schistose inclusions of biotite, hornblende, and garnet.

Cooke granite. - A medium-grained rock consisting of quartz and orthoclase accompanied by subordinate ferromagnesian minerals.

The succeeding Paleozoic formations occurring within the district, their thickness, and distinguishing characteristics are given in table 15 (4).

TABLE 15. - Paleozoic formations in the New World district

Period	Formation	Thickness	Character
Mississippian	Madison	150	Medium to massive-bedded light-gray limestones, highly fossiliferous.
Devonian	Three Forks	100	Alternating light and dark limestones and shales with shales predominant at the lower horizons.
Devonian	Jefferson	125	Alternating thin-bedded limestones and shales grading upward into dense gray limestone.
Ordovician	Big Horn	175	Dark to light gray limestones marked in part by nodules of black chert.
Cambrian	Gallatin	400	Alternating thin-bedded limestones and shales. Lower member marked by oolitic limestone.
Cambrian	Gros Ventre	450	Medium to thin-bedded limestones, shaley limestones, and dark shales.
Cambrian	Flathead	90	Glauconitic sandstones and quartzites.

Early Tertiary breccias comprise about 15 percent of the bedrock exposed in the district. These breccias are 150 to 2,000 feet thick. They range from acidic to basic and are composed of andesite, latite, dacite, basalt, and tuff. Induration of these breccias near intrusive monzonite contacts indicate their prior emplacement.

The Tertiary breccias and underlying Paleozoic sediments are invaded and capped by intrusives and volcanics, which include gabbro, monzonite, andesite, and tuff. Gabbro appears to be the earliest of the intrusive series.

Porphyritic monzonites occur in a variety of forms, which include sills, stocks, laccoliths, and dikes. These rocks have produced marked contact effects on most of the adjoining sediments and in turn, have been intensely altered by hydrothermal action.

The New World district is on the southwest flank of the broad Absaroka-Beartooth uplift. Consequently, the sedimentary series has a gentle but persistent dip of about 12° to the south. No major faults have been recognized. The district's reticulate system of both pre- and post-mineral fractures, however, probably is a minor expression of the tremendous regional pattern resulting from forces responsible for the uplift. Lovering considers the district's fault system to have developed largely through Tertiary time (4).

With few exceptions the known lodes and principal mines in the district are confined almost entirely to areas within or closely adjoining a monzonitic stock.

The lode deposits of the district have been classified as follows (4):

1. Contact-metamorphic
    a. Copper-lead-gold deposits

2. High-temperature veins
    a. Pyritic copper deposits
    b. Quartz-gold deposits

3. Moderate-temperature veins
    a. Copper-lead
    b. Lead-silver and complex lead-silver-zinc
    c. Carbonate-silver

The contact metamorphic deposits are marked by abundant pyrite, some chalcopyrite, subordinate galena, and sphalerite. These deposits are most typically developed in the Gros Ventre limestone adjacent to monzonitic rocks. Their economic value is primarily in gold and copper, although some silver is recovered.

Pyritic gold-copper deposits are commonly associated with monzonitic and gabbroic intrusives. These deposits are marked by abundant pyrite and large amounts of quartz. The enclosing rocks exhibit a pronounced alteration halo characterized by chlorite and sericite.

The moderate-temperature veins are fracture fillings and replacements usually found in the limestone series. Although these veins may be subdivided into several types based on dominant metal associations, they appear to merge and have numerous features in common. Rhodochrocite, psilomelane, and ankerite are characteristic gangue minerals that usually accompany these veins. Pyrite also is often present but generally in relatively small amounts. The quartz associated with these veins is commonly cloudy in appearance and fine-grained in texture.

In 1948, lode-mining activities in the district were limited to two open-cut operations, one underground operation, and a single, small-scale prospecting venture. In addition, a small amount of exploratory churn drilling for placer gravels was performed in the upper Stillwater River Basin.

Only a small part of the underground workings resulting from the numerous earlier operations were accessible to inspection. The description of many of these properties, therefore, is based largely on the published results of earlier studies.

Alice E. (Au)

The Alice E. is a patented claim owned by G. A. Packard, Cooke, Mont. It is on the south slope of Henderson Mountain in sec. 24, T. 9 S., R. 14 E., and is reached by a mile of maintained mountain road north from Cooke.

The property is reported to have produced about 2,500 tons of ore containing $14 in gold a ton during the period 1893-1895 (4). This ore was treated in a small cyanide plant on the property. Increasing concentrations of pyrite, which seriously hampered the milling process, finally obliged Packard to abandon the operation.

The ore body exposed on the Alice E. claim is in the Flathead quartzite adjacent to a small gabbro plug (fig. 6). The ore is largely massive pyrite in a siliceous gangue. The pyrite has been altered to limonite for a short distance below the surface. Exposures suggest that the deposit may be 250 feet wide and 1,000 feet or more in length. The deposit strikes about N. 10° -15° W. and appears to dip steeply westward.

The greater part of the reported output evidently was taken from an open-cut near the south limit of the property. Several caved adits and a caved shaft are disposed along the strike of the deposit over a distance of 1,000 feet and a vertical range of 200 feet.

All workings other than the open-cut are inaccessible. The property is completely unequipped; the few remaining buildings are in ruins.

Big Blue (Pb, Ag)

The Big Blue is a patented claim in sec. 26, T. 9 S., R. 14 E., owned by John Kountz, Bozeman, Mont. In 1948 the claim was under lease to W. E. Gookin, Cooke, Mont. Access to the property is over 1 mile of unimproved mountain road northwest from Cooke.

Available information suggests that about 400 tons of ore containing 30 percent lead has been produced from the deposit (4). In 1941 25 tons of ore averaging 23 percent lead and 9 ounces silver a ton was extracted. Bulldozer trenching in 1947 disclosed a small pocket of high-grade galena, which is reported to have yielded about 1,000 pounds of ore.

The deposit consists of small lenses and stringers of galena and lead carbonate enclosed by the lower beds of the Big Horn dolomite. These beds are extensively crushed by faulting. Pyrite is closely associated with the galena in a quartz gangue.

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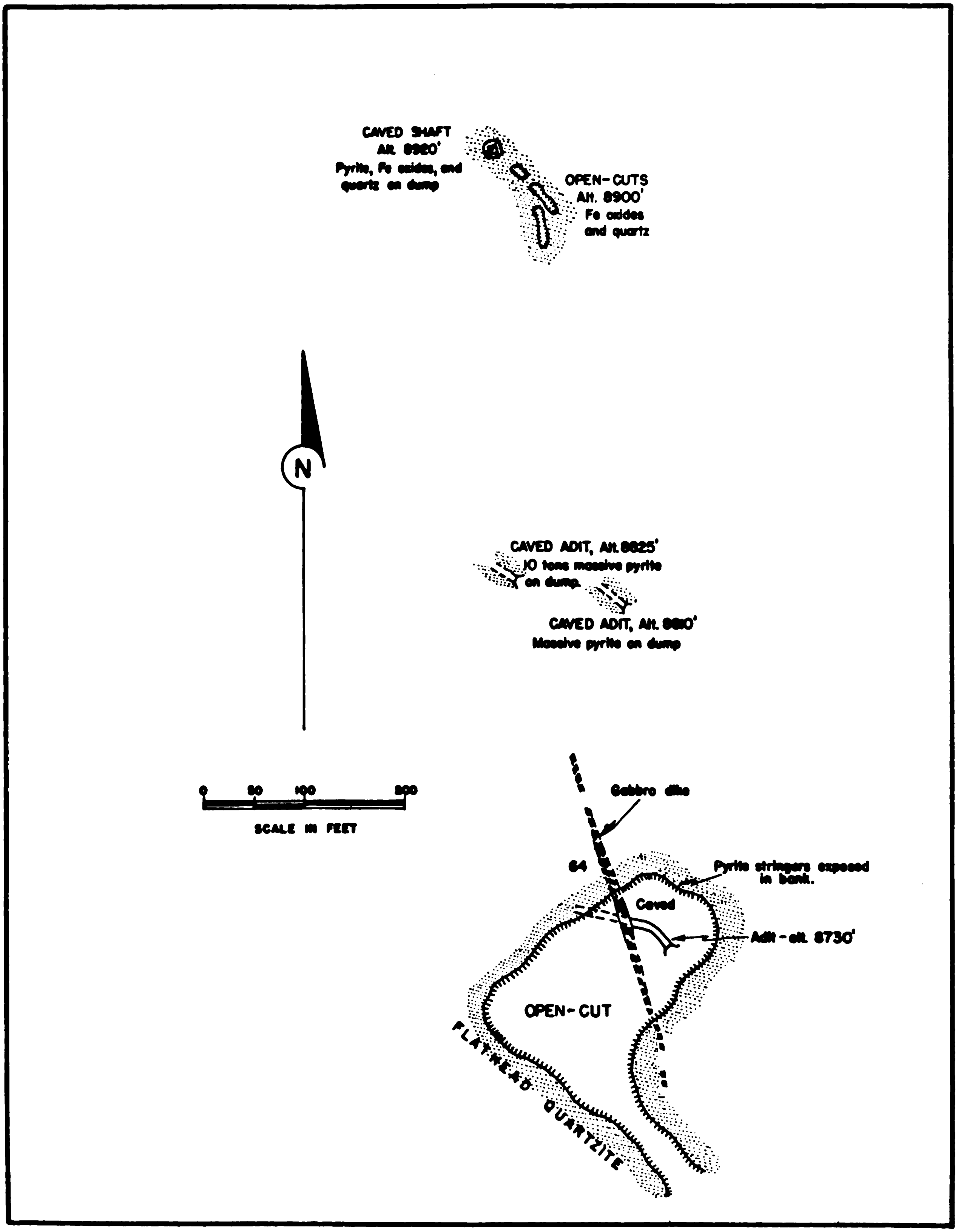


Figure 6. - Geologic sketch, Alice E. prospect, New World district, Park County, Mont.

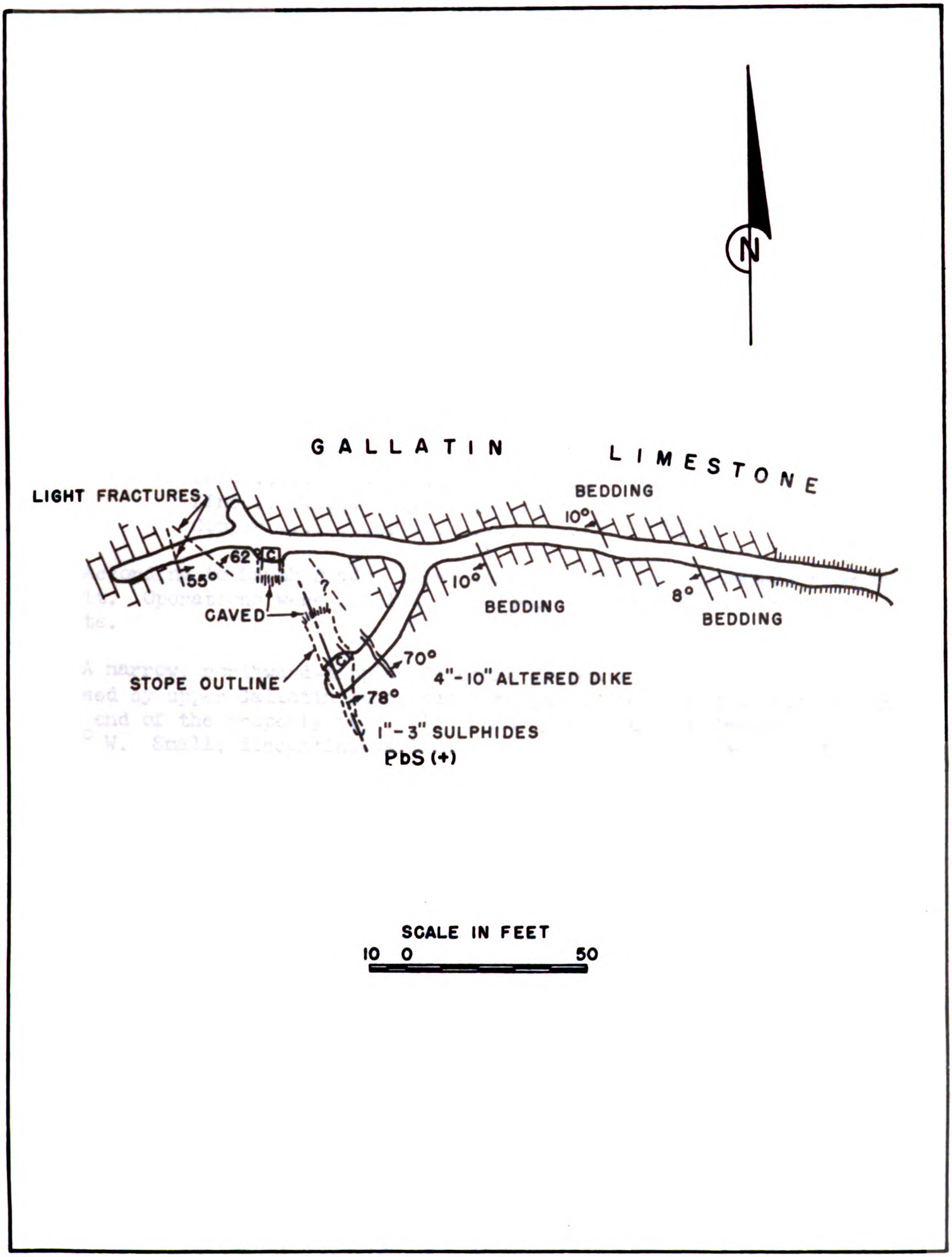


Figure 7. - Black Warrior adit, New World district, Park County, Mont.

The underground workings, which now are completely inaccessible, appear to have a horizontal extent of about 500 feet over a vertical range of 200 feet. The claim is currently dormant and entirely unequipped.

Black Warrior (Pb, Au, Ag)

The Black Warrior is one of six patented claims in secs. 14 and 15, T. 9 S., R. 14 E. These claims are owned by Sarah Brady, Livingston, Mont., and John Johnson, Salmon, Idaho. Access to the property is over 4 miles of improved mountain road and 1 mile of wagon trail northwest of Cooke.

In 1945 about 41 tons of ore was shipped in two lots to the A. S. & R. smelter at East Helena, Mont. The average metal content of these shipments was as follows:

	Oz. per ton
Gold	0.64
Silver	14.8
	Percent
Lead	17.1
Zinc	3.6
Copper	0.11

According to Sarah Brady, these were the only ores produced from the deposit. Operations were concluded in 1945; the property has remained idle to date.

A narrow, northward-dipping fracture system 4 inches to 4 feet in width, enclosed by upper Gallatin beds, has been partly developed by adit at the south end of the property (fig. 7). This system strikes from N. 25° W. to N. 37° W. Small, discontinuous lenses of rich galena ore ranging from several inches to 2 feet in width have been mined to surface over a vertical range of 90 feet. Subordinate pyrite, chalcopyrite, and sphalerite are contained in a gangue of quartz, calcite, and altered limestone. No oxidation products other than limonite were observed.

A second member of this vein system has been explored by a shallow shaft about 900 feet to the northwest. Although the shaft workings were inaccessible, dump material indicated the deposit is enclosed by Gallatin limestone. Rich ore fragments more than 10 inches in diameter attest to the presence of a deposit of possible economic interest. The constituent sulfides are identical with those found in the oreshoot to the south. These ore fragments, however, were characterized by a large amount of pyrite. A nearby small monzonite porphyry plug may have influenced mineral deposition considerably at the north end of the vein system.

A grab sample of the richest ore fragments at the shaft dump assayed as follows:

Ounce		Percent		
Gold	Silver	Copper	Lead	Zinc
0.84	19.72	0.4	10.2	10.0

The accessible underground workings on the Black Warrior claim total about 280 feet. An ore bin and two small shops are on the property. These structures have been ruined by heavy snowfall. A few scattered pieces of abandoned equipment at the property include an I. R., portable, 120-cubic foot compressor, a small gas engine, and a small hoist. This equipment has been rendered useless by weathering and vandalism.

Duke (Pb)

The Duke is an unpatented claim in sec. 26, T. 9 S., R. 14 E., owned by Harry Stintson, Cooke, Mont. It is on the south flank of Miller Mountain at an altitude of 8,300 feet. Access to the property is over a 3/4-mile, unimproved mountain road northwest from Cooke.

Nothing is known concerning the production except that the property is credited with having been a "fair" producer of high-grade lead-silver ores prior to 1885 (4).

Ore fragments from the dumps contain galena, pyrite, and sphalerite in a quartz gangue. The enclosing rock is limestone of the upper Gallatin formation.

The underground workings are completely inaccessible. No information is available regarding their extent, or the attitude and size of the explored vein.

Glengarry (Au)

The Glengarry group, containing 28 patented claims, is at the head of the Clark Fork Basin in sec. 12, T. 9 S., R. 14 E. The property is owned by the Cooke Mining Co., New York City, N. Y. It is reached by 2 miles of State highway and 4-1/2 miles of unimproved mountain road north of Cooke.

The property was aggressively explored and developed during the period 1920-1926; it has been idle since 1927. According to reports, several thousand tons of low-grade, pyritic, gold-copper ore has been blocked out. No production is recorded for the operation, however.

Mine workings on the Glengarry group have explored and partly developed a contact metamorphic deposit containing pyritic gold-copper ores. This deposit is enclosed by Gros Ventre limestone near contacts with gabbro and monzonite porphyry. The limestone and shales of the Gros Ventre formation have been silicified and pyritized locally. The predominant ore minerals are auriferous pyrite and chalcopyrite with occasional minor amounts of bornite and chalcocite. The long axis of the deposit strikes northwest and dips about 20° SW. (4).

The now completely inaccessible mine workings, consisting of four adits, are reported to have an aggregate length of about 3,100 feet. These workings extend over a horizontal distance of 2,300 feet and a vertical range of 450 feet.

The mine and mill plants include several buildings, all in poor repair. Two compressors, an Ingersoll-Rand type 10 and Ingersoll-Rand type 14, installed on the property are dismantled. A 25-ton flotation mill driven by a 150-horsepower Diesel engine also has been largely dismantled. The remaining mill equipment is in poor condition. Much of it is unusable and has little value other than for salvage.

Homestake (Au, Cu)

The Homestake group includes 18 patented and 2 unpatented claims in sec. 11, T. 9 S., R. 14 E., along the crest and northeast slope of Henderson Mountain. The property is owned by the Parkmont Mining Co., Cooke, Mont. It is reached by 2 miles of highways and 4 miles of unimproved mountain road to the headwaters of the Clark Fork of the Yellowstone River.

Production prior to 1890 amounted to 420 tons of ore valued at $23,000. This ore was extracted from the Daisy and Homestake claims. During 1904-1925, a considerable amount of development work was completed, a hydroelectric plant was installed, a copper smelter was built, and an aerial tram from smelter to mine portal was completed (4). In spite of the large sums expended, no ore was produced and the promotion collapsed. The property remained idle up to 1947, when the recent operation was started by the Parkmont organization. The present operation is treating about 70 tons of $11 ore daily.

The deposit currently being exploited is of the contact metamorphic type. A xenolith of Gros Ventre limestone enclosed and partly invaded by monzonite porphyry has been highly altered and mineralized along a complex fracture network. A series of irregular, flat-lying ore bodies contained in the xenolith was undergoing development in 1948. The predominant ore minerals are chalcopyrite and auriferous pyrite with oxides of copper, iron, and manganese. The limestone gangue is silicified and highly altered.

The deposit is being mined by a small open-cut precariously perched at an altitude of 9,700 feet near the top of the steep northeast face of Henderson Mountain. Although the extent of the deposit is hidden by a layer of blocky talus, it appears to range from 20 to 60 feet in width and strikes about N. 10° to 15° E. The structure exposed in the bank of the open-cut is essentially flat-lying.

From the meager available evidence, it may be inferred that the reserves would approach 100,000 tons containing about 1 percent copper and 0.15 ounce gold a ton. Owing to particularly unfavorable topography, only a small part of this reserve may be recoverable by open-cutting.

Mining operations are currently conducted by a 1/2-cubic yard Koehring 75-horsepower Diesel shovel and a small Sullivan wagon drill powered by a 320-cubic foot Jaeger gasoline-driven compressor. The broken ore is contract-hauled in 8-ton loads 3 miles to the mill-head bin and stock pile. The underground workings completed during prior operation now are completely inaccessible.

The mill plant is of the combined gravity-flotation type. Free gold is recovered by amalgamation of jig concentrates. The plant is powered by a

260-horsepower General Motors tank twin Diesel driving a 225-kv.-a. generator. As the time of inspection the mill had just been completed; consequently, no reliable data regarding operation or recoveries were available. It is planned to avoid seasonal interruption of the milling operation by stock-piling during the brief mining season.

Irma-Republic (Pb, Ag, Zn)

The Irma Mines Corp. owns 8 patented and 29 unpatented lode-mining claims in secs. 35 and 36, T. 9 S., R. 14 E. The property is reached by 1-1/2 miles of improved mountain road south from Cooke along the east flank of Republic Mountain.

The property contains the first vein system discovered in the New World district. This vein, the Republic, was actively exploited in the late 1880's, in 1906, and during the period 1918-1920. In 1920 the Republic vein structure was identified to the south beyond the limits of the original Republic holdings. This discovery was exploited by the newly formed Irma Mines Corp., L. H. Brooks, manager, which later acquired the Republic property holdings. A small concentrator was built on the Irma property in 1938. Small-scale production of both concentrates and direct shipping-grade ores have proceeded steadily to the present.

The Irma-Republic vein system is a series of fracture fillings and replacements enclosed by the oolitic beds of the lower Gallatin formation. This system, striking about N. 30° -40° W., has been explored by prospect openings and mine workings over a length of 2,700 feet and a vertical range of 250 feet.

Individual ore shoots apparently are structurally related to an intersecting pattern of steep-dipping fractures and sheeted zones. Replacement processes also have been locally active at certain bedding horizons. The entire fracture system appears to stem from forces relieved along a large, east-west, pre-mineral fault lying between the Irma and Republic workings (fig. 8).

The fissure veins normally range from several inches to several feet in width. They occasionally swell to pipelike ore shoots 15 or more feet in diameter at intersections with other members of the fracture system. The upper limit of the veins and ore shoots is marked by the dark-green fissile shale that comprises the parting between upper and lower members of the Gallatin formation. Although development in depth has been retarded by water-disposal problems, the underlying Gros Ventre formation is the object of considerable speculation and is marked for early exploration.

The veins and ore shoots contain medium- to fine-grained complex lead-zinc-silver ores in a quartzose, manganiferous gangue. The predominant primary minerals are galena, sphalerite, pyrite, argentite, and rhodochrosite. The common secondary minerals are lead and zinc carbonates, pyrolusite, psilomelane, quartz, and calcite. Proustite has been reported; however, its occurrence is rare in the accessible workings (4). Direct shipping-grade ore contains about 40 ounces silver a ton, 20 percent lead, and 6 percent zinc. Milling-grade ore contains about 12 ounces silver a ton, 4 percent

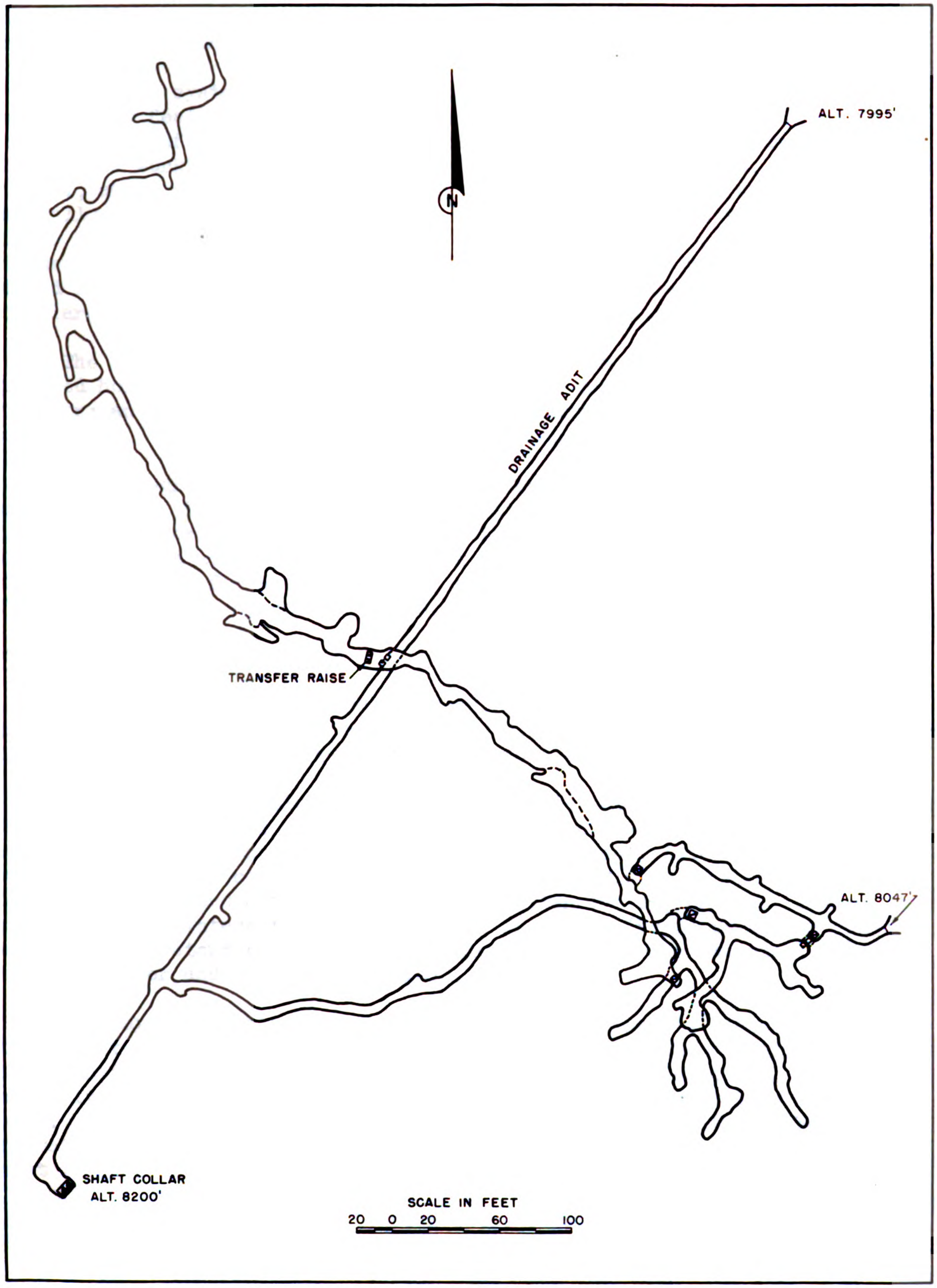


Figure 8. - Underground workings, Irma mine, New World district, Park County, Mont.

lead, and 5 percent zinc. Owing to the absence of adequate geologic data, no reliable estimates of reserves can be made at this time.

The vein system has been developed by underground workings totaling about 5,000 feet. These workings are grouped around the Black Rock shaft, the Martin shaft, and the Republic adits; they are not interconnected. The Black Rock workings consist of a 250-foot 2-compartment shaft, a lower drain tunnel, and a short adit connected by raises with the lower drifts (fig. 8). A shallow prospect shaft and several short drifts comprise the Martin workings. The Republic workings consist of several short crosscut adits leading to several thousand feet of drifts and raises. In 1948 most of the ore produced was taken from the Black Rock workings. The reopening of a part of the largely inaccessible Republic workings was being started.

The mine plant is equipped with a single-drum, 20-horsepower, gasoline-powered hoist; a 9 x 8, class I R-1 compressor driven by a McCormick-Deering tractor; and a Chicago-Pneumatic 9-1/2 x 18 compressor direct-connected to an oil engine. All ores are hoisted by bucket and trammed to the mill-head bin.

Milling-grade ores are treated by selective flotation in the 35-ton concentrator. The crushing section of this plant is powered by a Fordson industrial motor. The milling section is belt-driven by a Caterpillar Diesel 75 rated at 110 horsepower. In normal operation, the crushing section is operated for a single 8-hour shift, whereas the fine-grind and flotation sections operate 16 hours.

McLaren (Au, Cu)

The McLaren Gold Mines Co., Dayton, Ohio, owns 6 patented and 25 unpatented claims in secs. 10 and 11, T. 9 S., R. 14 E. Access to the property is over 4-1/2 miles of improved mountain road north of Cooke.

Small-scale operations were started in 1933 at the New Year's Gift claim on the southwest flank of Red Mountain. In late 1934, a concentrating plant was constructed by the company at Cooke. This plant, later destroyed by fire, was redesigned and rebuilt. In 1938 the Newmont Mining Corp. acquired an interest in the property and undertook an extensive exploratory core-drilling program. This interest was relinquished in 1940. The property has since become a consistent producer. Production since 1933 has amounted to 824 tons of copper and 36,000 ounces gold.

The deposit consists of pyritic gold-copper minerals disseminated throughout a xenolith of Gros Ventre beds and part of the overlying lower Gallatin formation. The sedimentary rocks are surrounded on all sides by monzonite porphyry. Minable ore has been found only within Gros Ventre beds. Small sulfide stringers are, however, found to penetrate the Gallatin formation as well as the adjoining monzonite. Mineralization appears to be most intense at the intersections of a complex fracture network.

The deposit, as exposed by open-cuts, is 20 to 40 feet thick and about 500 feet long. It strikes about S. 10° to 15° W. and is nearly flat-dipping. According to company officials, the ore body has been traced by core-drilling for an additional 1,000 feet along the strike. Significant extensions in depth also were reported.

The predominant ore minerals are pyrite, chalcopyrite, bornite, covellite, native copper, and several oxidized copper compounds. Occasional specks of galena and sphalerite also were noted. Run-of-mine ore contains 0.1 to 0.4 ounce gold a ton and 0.8 to 1.5 percent copper. Inferred reserves may amount to more than 300,000 tons.

All ore is mined by open-cut methods and hauled by two 15-ton Euclid trucks to stock piles and head bins at Cooke. The open-cut is equipped with a 3/4-cubic yard P & H shovel, a Bay City 1/2-cubic yard shovel, two 320-cubic foot gasoline-powered compressors, a wagon drill, and jackhammer. The open-cut originally was designed for a strip ratio of 2 to 1, but actually the ratio is somewhat higher. Mining generally is possible only from May to October. In spite of these handicaps, annual production has approached 40,000 tons of crude ore mined and milled.

The McLaren concentrator at the east edge of Cooke is a combined bulk flotation-gravity plant having a nominal capacity of 200 tons. In 1948 this plant was treating about 185 tons daily. The resulting concentrates, which contain about 1.2 ounces gold a ton and 11 percent copper, are trucked to Gardiner and shipped to the Anaconda smelter for treatment. The completely electrified mill plant is powered by three Diesel-driven generators having a total rated output of 571 kv.-a.

Mohawk Warrior (Pb, Ag)

Three patented and five unpatented claims in the SE1/4 of sec. 25, T. 9 S., R. 14 E., are owned by the Mohawk Mining Co., Miles City, Mont. The claims are reached by 1 mile of unimproved road along Woody Creek southeast of Cooke.

Following initial exploration during 1921-1926 the property remained dormant until 1947, when a small-scale prospecting venture was started by H. E. Gookin and W. C. Flat of Cooke, Mont. No ores have been produced from the property to date.

A narrow, persistent, sheeted zone in the Flathead quartzite and the overlying Gros Ventre limestone has been explored by shallow prospect pits and mine openings over a horizontal distance of 300 feet and a vertical range of 100 feet. The zone strikes N. 10° W. and dips about 75° E.; its average width is less than 3 feet.

Seams of coarse-grained sulfides ranging from 1 inch or less up to 3 inches in width are sporadically distributed within the zone. The ore contains galena, tetrahedrite, and subordinate sphalerite in a quartz gangue stained with manganese oxides. Argentite, polybasite, and native silver have been recognized in specimens. A selected character sample taken from a 2-inch sulfide stringer contained 56 percent lead and 720 ounces silver a ton.

The only accessible opening on the vein is a short prospect adit in the lower glauconitic beds of the Flathead quartzite. Other workings presumably on the vein include two shallow shafts and an upper adit. A third adit 300 feet southwest of the vein has been driven in an andesite sill (fig. 9).

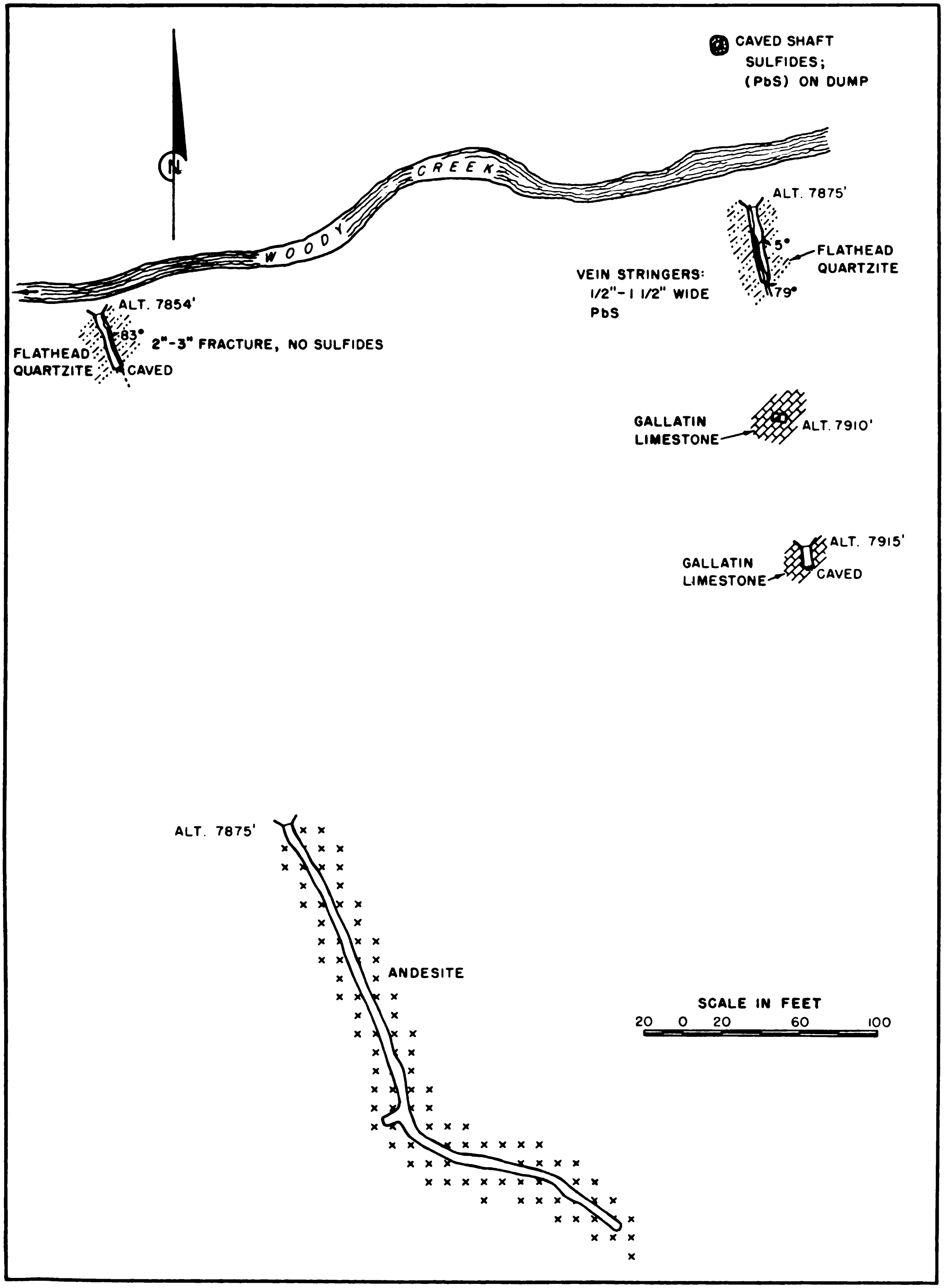


Figure 9. - Mohawk Warrior mine, New World district, Park County, Mont.

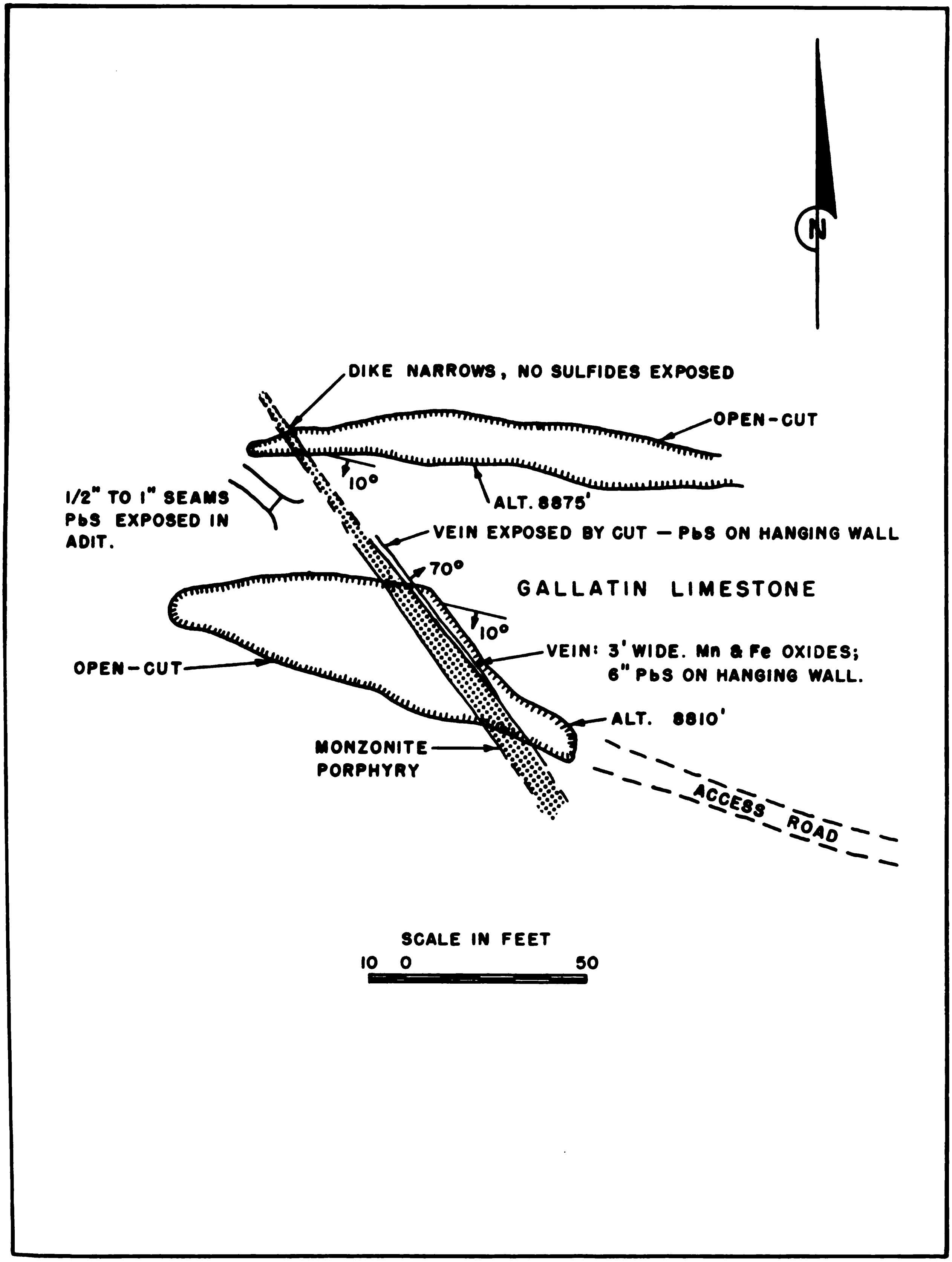


Figure 10. - Geologic sketch of the New World prospect, Park County, Mont.

The property has been improved with log structures used for shops and living quarters. Mining equipment includes a headframe at the upper shaft, a stationary compressor driven by a 25-horsepower gasoline engine, a 380-cubic foot gasoline-powered portable compressor, and a complement of small tools.

Morning Star (Pb, Ag)

The Morning Star is a patented claim in sec. 23, T. 9 S., R. 14 E. It is owned by Sarah Brady, Livingston, Mont., and Adolph Whetzstein, Fort Wayne, Ind. Access to the property is over 1-1/2 miles of improved mountain road and 2 miles of truck trail northwest of Cooke.

The property is reputed to have produced lead ore during the early period of the district's development. According to Sarah Brady, a carload of coarse-grained galena-silver ore valued at $93 a ton was produced and shipped to the East Helena smelter in 1922. The property has since been completely idle. The workings are inaccessible, and all equipment has been removed.

Ore fragments from the dump contained coarse-grained galena, chalcopyrite, and small amounts of argentite in a siliceous gangue. The vein is enclosed by the Big Horn dolomite. According to reports it is a vertical fracture 2 to 4 feet wide striking N. 20° W. The upper part of the vein is said to be strongly oxidized and contains an appreciable amount of anglesite and cerussite (4).

The underground development is reported to total about 700 feet over a horizontal extent of 600 feet and a vertical range of 100 feet.

New World (Pb, Ag)

The New World is a patented claim owned by the Buffalo-Montana Mines Co. in sec. 23, T. 9 S., R. 14 E. It is reached by 1-1/2 miles of unimproved mountain road east from Cooke.

According to reports, the property was active prior to 1886 and was worked for a short period in 1907. Production is said to have amounted to about 2,000 tons of mixed coarse-grained lead sulfide and carbonate ore containing 1 ounce gold a ton. The property was prospected in 1947. The results of this recent work, however, were not particularly encouraging.

The ore shoots are said to occur in irregular, flat-lying pipes enclosed by Gallatin limestone. These shoots ranged from 22 feet by 7 feet down to 5 feet by 4 inches in cross section. Their average cross section was estimated at 7 by 7 feet (4).

A recent open-cut exposed a small, discontinuous vein at the contact between the limestone and a monzonite porphyry dike (fig. 10). This vein ranges from 4 inches to 3 feet in width over a horizontal range of 60 feet. It strikes N. 35° W. and dips 70° NE. Manganese and iron oxides with occasional small nodules of galena and cerussite are contained in a siliceous gangue of altered limestone and monzonite porphyry.

The earlier workings are inaccessible. All equipment has been removed, and the recent prospect has been abandoned.

Stump (Pb)

The Stump property consists of one patented claim in sec. 26, T. 9 S., R. 14 E. It is owned by the Yellowstone Mining Co., Cooke, Mont. Access to the property is over a 3/4-mile, steep, unimproved mountain road northwest from Cooke.

No information concerning the property's production is available. A large amount of zinc-free lead, however, is stated to have been shipped to the old Republic smelter at Cooke. Exploitation of the deposit probably was in progress during the late 1880's. Underground workings reported as having a combined length of more than 800 feet now are entirely inaccessible.

Available information indicates that the ore was found in flat-lying lenses along bedding in the Gallatin limestone (4). These ore shoots are said to strike about N. 80° W. and dip 5° to 7° S. They ranged from 2 inches to 2 feet in thickness. The predominant primary sulfide is galena associated with chalcopyrite, pyrite, and sphalerite in a quartz gangue.

The lower workings penetrated the Gros Ventre formation. Nothing is known concerning the occurrence of ore shoots at this horizon.

The property is unequipped and presumably has been inactive since the closing of the Republic smelter in 1887.

Tredennick (Au)

Five patented claims in secs. 1, 2, 11, and 12, T. 9 S., R. 14 E., are owned by the Tredennick Development Co., Cooke, Mont. These claims are on the southeast flank of Scotch Bonnet Mountain. They are accessible by 2 miles of State highway and 5 miles of unimproved mountain road north from Cooke.

Prospecting activities following World War I disclosed a small pyritic copper deposit along a gabbro-granite contact. In 1922, development of the deposit was started by a lower crosscut adit. Financial difficulties necessitated termination of this work a short distance from its objective. The property has been idle since 1924. No indication of production appears in available records.

Pyritic gold-copper ores occur in pre-Cambrian granite along a sheeted zone adjacent to a gabbro contact. This zone strikes about N. 55° E. and dips 60° S. It ranges from several feet up to 30 feet in width. The predominant ore minerals are auriferous pyrite and chalcopyrite; these are associated with minor amounts of galena and sphalerite in a gangue of ankerite and quartz. The ore is reported to contain up to 0.5 ounce gold a ton (4).

The underground workings, which total about 1,200 feet in length, are completely inaccessible. Several buildings and shops at the lower adit have been largely destroyed by heavy snowfall. All equipment has been removed from the property.

Other Prospects

A number of other mineral deposits were prospected in the early days of the New World district. Among these are the Carlton (Pb-Ag), Commonwealth (Cu), Chipmunk (Pb-Ag), Elizabeth (Cu), Longstreet (Cu), Lula (Cu), Shoo Fly (Pb-Ag), and U. S. Treasury Mint (Pb-Ag). The underground workings now are uniformly inaccessible. Little factual information could be obtained, although a few impressions concerning the mineral associations and enclosing rock were recorded during inspections made of the dumps of the old workings. The meager data available have been summarized in the table appended at the end of this report.

Goose Lake District

Location and access. - The Goose Lake district, embracing an area of about 8 square miles, is contiguous to the New World district on the north. Access to the area from Cooke is by 7 miles of unimproved mountain road to the Clark Fork Basin and 4 miles of steep, rough wagon trail.

Topography. - The region has an altitude ranging from 9,000 to 11,500 feet. The Goose Lake shore line is about 10,000 feet above sea level. Cirques, hanging valleys, and small glacial tarns are abundant. The remnants of a receding glacier can be seen 1 mile northeast of Goose Lake.

Drainage is by a series of small lakes and connecting streams into the Goose Creek Valley along the district's south margin. Goose Creek is one of the main headwaters of the Stillwater River.

Although parts of the area commonly are snow-free for 3 months of the year, the north slopes and higher elevations are usually snow-covered the year around.

Timber and water supply. - Merchantable timber is entirely lacking throughout the district. Occasional small clumps of stunted and gnarled fir grow in protected positions and at the lower altitudes. The meager soil cover flanking the lake basins and streams supports a variety of alpine plants, heather, and buck brush.

The region is abundantly supplied with water from melting snow by a network of small ponds, lakes, springs, and streams. Although many of these are frozen during the long winter, Goose Lake maintains a steady flow into Goose Creek throughout the year.

History. - Sporadic prospecting of the Goose Lake district closely followed initial explorations in the New World district. Difficult access and short seasons, however, discouraged aggressive exploration until 1904. In 1906, patents were obtained for several lode claims at the northeast end of the lake by the newly organized Copper King Mining Co. Surface and underground work at this property was continued for two seasons and terminated in 1907. With the exception of a few small prospecting ventures, the district has been dormant since 1910. No ores have been shipped from any of the district's prospects.

Geologic setting. - The Goose Lake and New World districts in general have a common geologic background with only minor differences. Deep erosion in the Goose Lake region has exposed the Archean crystallines through complete removal of both Paleozoic and Mesozoic sediments.

In addition to the Goose Creek and Cooke granites, a third Archean crystalline has been found a short distance north of Goose Lake. This rock has been classified (4) as gabbro gneiss.

Small plug of Tertiary gabbro, monzonite, granite, and syenite center around Goose Lake. The syenite appears to grade progressively through granodiorite into gabbro. Its predominant composition is orthoclase and albite accompanied by biotite, hornblende, and quartz. The district's few known mineral deposits are either in or closely associated with these Tertiary intrusive rocks. The recognized structural relations between the intrusives and the Archean rocks are indicated in figure 11.

In 1948 all underground workings were inaccessible and most of the open-cuts were filled with surface wash. Most mineral associations could be determined roughly by material on the waste dumps. Dimensions and attitude of the vein structures were generally obscured. In the following descriptions of the prospects, therefore, considerable relaince has been placed on information obtained from publications.

Copper King (Cu)

The Copper King Mining & Development Co., Livingston, Mont., owns four patented lode claims at the north end of Goose Lake in sec. 18, T. 8 S., R. 15 E. Access to this area is indicated in figure 11. The property has been idle since its initial exploration in 1904-1907. Although a small quantity of ore was mined and stocked at the property, none was shipped.

The explored deposit is enclosed by a small syenite plug. It appears to strike northward and its width reportedly ranges from several feet to 20 feet. The ore is chalcopyrite, limonite, and malachite in a feldspar gangue.

According to W. B. Hart, Cooke, Mont., one of the original locators, ore containing 20 percent copper was found at the shaft collar. Material at the shaft bottom is reputed to contain up to 18 percent copper. A prospect trench near the shaft house exposed ore containing 20 percent copper, 2.87 ounces silver, and 0.1 ounce platinum a ton. Grab and character samples taken in 1948 from stocked ore assayed as follows:

	Ounce			Percent	
Sample	Platinum	Gold	Silver	Lead	Copper
Stocked ore, character...........	-	0.02	2.10	0.6	16.2
Stocked ore, grab................	0.04	0.03	1.69	-	10.7

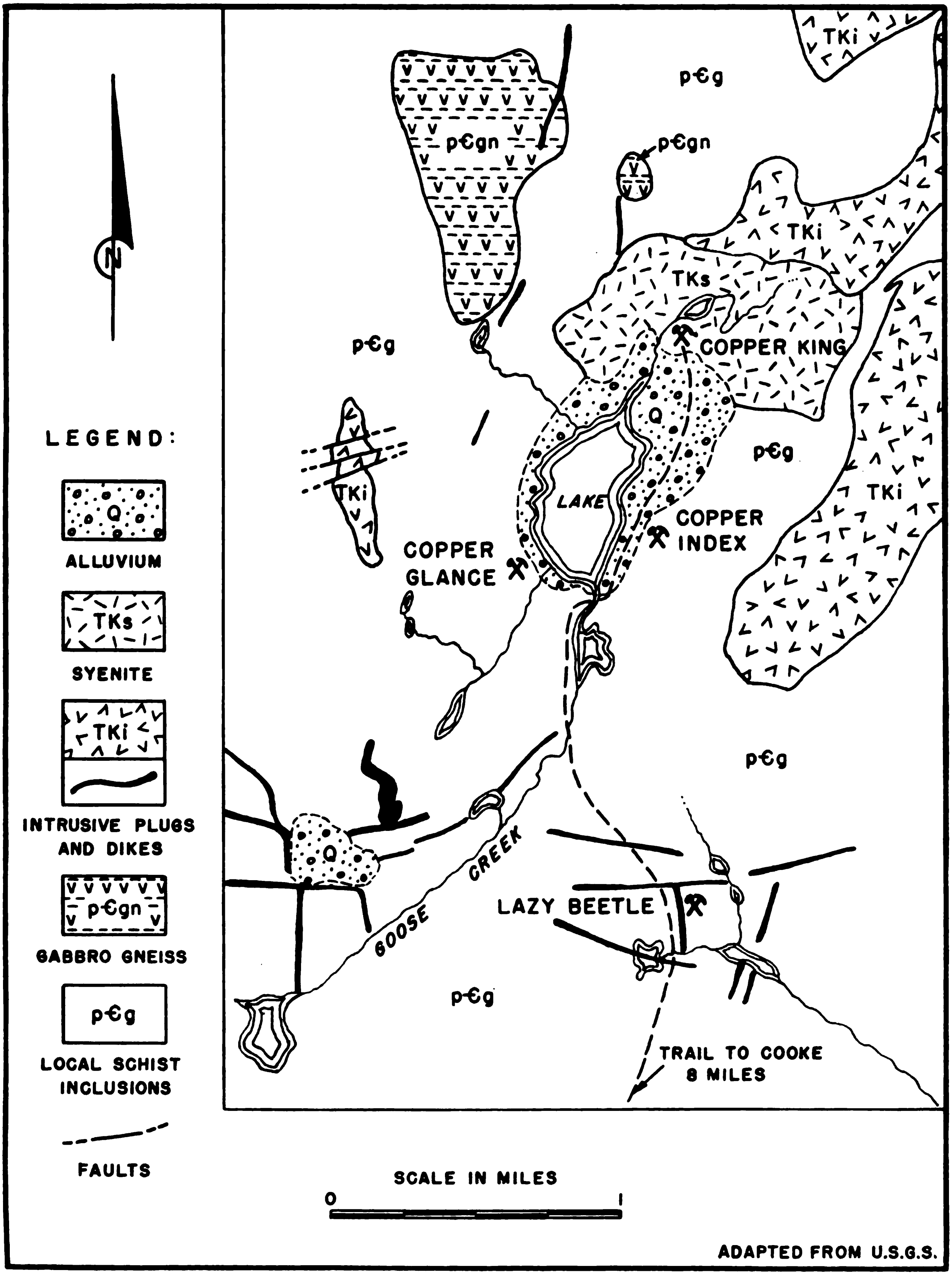


Figure 11. - Geologic map of the Goose Lake district, Park County, Mont.

Lovering regards the deposit as syngenetic in type and cites supporting mineralogical evidence (4).

No reliable information regarding the extent or grade of the deposit is available. A 100-foot exploration shaft near the edge of Goose Lake is flooded to the collar; the numerous open-cuts are almost completely filled with wash brought down by melting snows.

Other Prospects

Many other claims were staked and briefly prospected in the district early in the history of Goose Lake. A few of these prospects were explored by shallow underground workings. Most of the work, however, was limited to small, shallow test pits and trenches. The underground workings generally were inaccessible in 1948. The available information concerning the Hecela-Flora, Copper Glance, Copper Index, and Lazy Beetle prospects has been summarized in the table appended at the end of this report.

Emigrant District

Location and access. - The Emigrant district is in south-central Park County 24 miles by U. S. Highway 89 south of Livingston, Mont. Chico, Emigrant, and Pray are small settlements in the Yellowstone River Valley at the west margin of the district. Emigrant is on the Gardiner branch of the Northern Pacific Railroad, which joins the main line at Livingston.

Access to the district's interior is by county roads along Mill and Emigrant Creeks (fig. 12). These roads usually are closed in winter by heavy snowfall. In 1948 washouts destroyed the Emigrant Creek road beyond Chico. The district's mines and prospects are accessible from these secondary roads only by steep truck trails and Forest Service fire trails.

Topography. - The Emigrant district has been deeply carved by glacial action; consequently, it is extremely rugged. It is entirely above 6,000 feet in altitude. Unbroken slopes rising abruptly from the narrow valley floors culminate in ridges and spires 10,000 feet or more in altitude.

The region drains northwest into the Yellowstone River by a series of mountain torrents that race along the canyons and gorges of Emigrant, Mill, and Elbow Creeks and their tributaries.

Forestation. - The area generally is heavily forested with lodgepole pine, fir, and spruce up to an altitude of 9,000 feet. The forest cover above this level rapidly diminishes to scattered clumps of gnarled cedar and fir. Deciduous species are common along the main streams at the lower altitudes. Most of the forest areas contain stands of commercial timber suitable for mine-support and general construction.

Water supply. - The region's water resources are adequate to meet any anticipated combination of industrial, agricultural, and domestic demands. Only a small part of the persistent year-round stream flow currently is used for irrigation of the lower bench lands bordering the Yellowstone River Valley. Sites adapted to small-scale hydroelectric development exist on several of the larger streams.

Geologic setting. - The rocks exposed in the Emigrant district range from Archean to Tertiary (1) (fig. 12). The Archean rocks are similar to those in the Jardine district. The Paleozoic strata, represented by formations assigned to the Cambrian, Ordovician, Devonian, and lower Mississippian periods, conform in general with the series described by Lovering in the New World district (table 15).

Tertiary rocks occupying about half of the district include basic andesites, rhyolites, intrusive acidic andesites, and related granitics. The remaining area is covered mainly by Archean crystallines, minor Paleozoic outcrops, and Quaternary deposits along the Yellowstone River.

The district is on the west flank of the Absaroka-Beartooth uplift. This uplift has been split into two blocks by an extended east-west zone of high-angle faulting along Mill Creek (1). The south block, which contains most of the district's known mines and prospects, has been depressed several thousand feet stratigraphically below the adjoining north block (5).

Alice C (Pb, Ag)

The Alice C group contains one patented and two unpatented lode claims in sec. 23, T. 6 S., R. 9 E., owned by H. P. Stuart, Pray, Mont. Access to the area from Pray is over 10 miles of county and Forest Service roads eastward up the West Fork of Mill Creek. The property is on Bulldozer Creek about 1 mile above its confluence with the West Fork of Mill Creek.

According to Stuart, the deposit was discovered and opened in the 1890's. Underground exploration, consisting of two adits totaling 750 feet in length and a 130-foot raise to surface, was accomplished before the prospect was abandoned in 1904. No shipments have been made. All equipment has been removed.

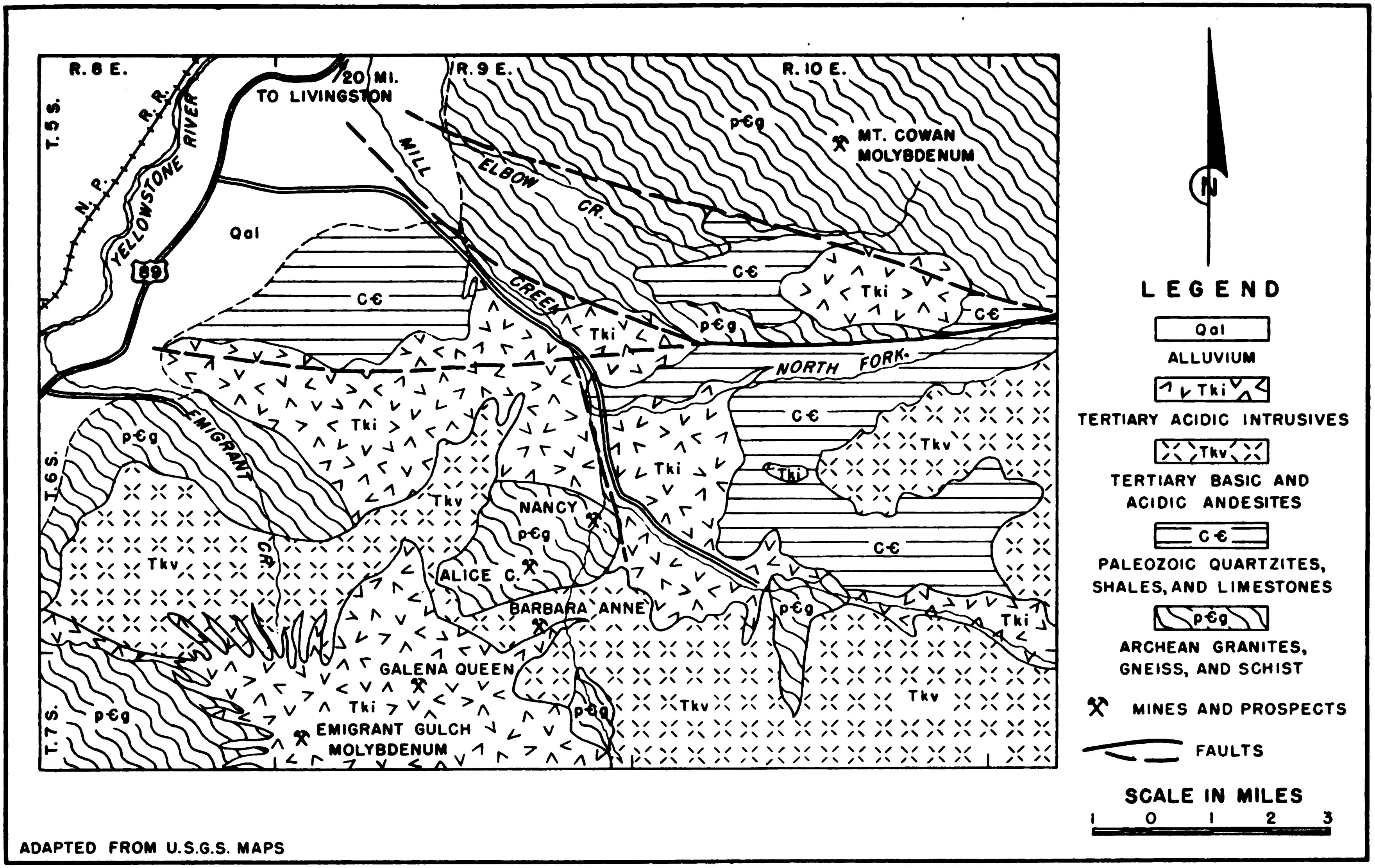
The workings explore a narrow fracture zone in pre-Cambrian biotite schist over a strike length of about 100 feet. The fracture, ranging from 1 to 3 inches in width, strikes N. 75° W. and dips 35° N. It closely follows the foliation of the enclosing schist. Small quartz stringers and lenses containing galena, sphalerite, and pyrite occur sporadically throughout the structure.

A large composite sample taken at intervals along the vein was assayed by the International Smelting & Refining Co. as follows:

	Percent
Lead	27.0
Zinc	3.5
	Oz. per ton
Silver	12.0
Gold	0.12

Barbara Anne (Ag-Pb)

The Barbara Anne prospect was discovered recently and opened on one of four contiguous unpatented lode claims in sec. 35, T. 6 S., R. 9 E. Access



ADAPTED FROM U.S.G.S. MAPS

Figure 12. - Geologic map of the Emigrant district, Park County, Mont.

to the property from Pray, Mont., is by 9 miles of county road along Mill Creek, then 8 miles of steep, rough, truck trail that follows the West Fork of Mill Creek and Arrastra Creek.

The claims, held by Kester Counts, Livingston, Mont., were being developed under a leasing agreement in 1947 and 1948. Test shipments totaling 53 tons were made to the A. S. & R. smelter at East Helena, Mont. Development was suspended, and all equipment was removed from the property in the fall of 1948.

A 25-foot, single-compartment shaft was sunk on the outcrop at an altitude of 8,300 feet. A 20-foot drift on the vein was driven from the shaft bottom. A crosscut adit 150 feet lower than the shaft collar was started in July 1948. The planned length of this adit was 210 feet to intersect the downward extension of the Barbara Anne vein.

The prospect is in an area of basic andesites on the northeast flank of Mineral Mountain. These andesites overlie pre-Cambrian and Paleozoic strata and, in turn, are partly covered by rhyolite flows. Occasional islands or xenoliths of quartzite, shale, and limestone occur in the andesite. Several isolated patches of these Paleozoic rocks are exposed within a few hundred yards of the Barbara Anne outcrop.

Two narrow quartz-filled fractures in a zone about 4 feet wide have been exposed by a 30-foot prospect shaft and several hundred feet of bulldozer trenching. This structure strikes N. 17° E. and dips 68° W. Its explored length is about 40 feet. Intermittent exposures made during trenching and road construction indicate a length of about 750 feet. Continuity, however, has not been established. A narrow footwall stringer about 25 feet east of and parallel to the main vein also was found during road construction. Its length has not been determined.

The ore consists of fine-grained galena, copper sulfides, and occasional blebs of sphalerite in a quartz-pyrite gangue. The tenor of the ore as mined is indicated by the following average smelter returns:

	Oz. per ton
Gold	0.8
Silver	12.1
	Percent
Lead	0.9
Copper	.3
Zinc	.3
Bismuth[1]	.26

[1] Determined on one lot only.

Two Bureau of Mines channel samples of the structure taken at one surface exposure assayed as follows:

Sample	Ounces		Percent	
	Gold	Silver	Lead	Copper
Full width (4.3 feet)	0.05	2.25	0.6	0.7
Richer footwall portion (2.3 feet)	.13	11.13	1.3	1.8

Emigrant Gulch Molybdenite (Mo)

The Emigrant Gulch molybdenite prospect is in sec. 6, T. 7 S., R. 9 E. The deposit is on one of a group of six unpatented lode claims held by W. L. Kearns, Livingston, Mont. Access to the area is by 2 miles of truck trail and 4 miles of pack trail south from Chico along Emigrant Creek. Chico is 31 miles south of Livingston, Mont., by U. S. Highway 89.

The deposit was explored in 1947 by the Hodges Mining Co. of Los Angeles, Calif. No ore is known to have been shipped from the property. The principal mineralized area has been explored over a vertical range of 215 feet by two adit workings totaling about 800 feet in length. The lower adit is at an altitude of 7,000 feet. All equipment has been removed from the property.

The underground workings explore a pipelike zone of brecciated and fractured trachyte porphyry about 150 feet in diameter. The fracturing diminishes in intensity and fades outward from the central part. Openings in the breccia and fractures are filled with pyrite, molybdenite, and traces of gold and silver.

The central brecciated zone contains 0.3 to 1.1 percent MoS_2. Channel and core samples taken from the fractured zone during development averaged about 0.07 percent MoS_2, up to 0.03 ounce gold and traces to 0.8 ounce silver a ton.

Galena Queen (Pb)

The Galena Queen group which contains two unpatented lode claims held by Kester Counts, Livingston, Mont., is in sec. 4, T. 7 S., R. 9 E. The property is reached by a 2-mile foot trail along Arrastra Creek from the Barbara Anne access road.

An unknown but presumably small amount of gold-bearing ore was produced from the property in the 1870's. Underground workings consist of a 55-foot, single-compartment shaft and a 180-foot adit driven on the vein structure. The ruins of a small arrastra lie a short distance below the adit portal. Although the adit is accessible, the walls and back are obscured by a thick deposit of iron oxides. The shaft is flooded to the collar.

The adit has exposed a small gash vein within a wide sheeted zone in rhyolite. The gash structure strikes N. 75° E., dips 79° S., and ranges in width from 2 inches to 1 foot. The sheeted zone strikes N. 65 E., dips vertically, and exceeds 400 feet in width.

The gash structures contain pyrite and coarse galena with minor amounts of sphalerite and chalcopyrite in a quartz gangue. The sheeted zone locally contains particles of finely disseminated galena mainly confined to areas of local silicification. A 100-foot chip sample taken from a stream-bed exposure of this sheeted zone contained 0.1 percent lead and traces of gold and silver.

Several lenticular bog manganese deposits have been found perched on the lower flanks of Arrastra Creek near the Galena Queen adit. These deposits are evidently remnants of larger basin deposits formed by interruption of the Arrastra Creek drainage. The individual lenses appear to have a plan area of less than 5,000 square feet and range in thickness from 3 to 6 feet. In places, sand, gravel, and cobbles have been cemented by manganese oxides into dense, conglomerate-like masses. Less frequently, the manganese oxides alone have built up spongy masses in which occasional organic remains are found. Samples containing up to 40 percent manganese are said to have been taken from the deposits.

Mt. Cowan Molybdenum (Mo)

The Mt. Cowan molybdenum prospect is in sec. 22, T. 5 S., R. 10 E. It is on one of a group of 12 contiguous unpatented lode claims held by Kester Counts, Livingston, Mont. Access to the property from Pray, Mont., is by 12 miles of county road along Mill Creek to the Snowy Range ranch, thence by 7 miles of rough pack trail north to Frozen Lake on the south flank of Mt. Cowan. Frozen Lake is about 9,000 feet in altitude.

No workings other than shallow location cuts have been opened. However, bedrock exposures resulting from deep glacial carving are abundant in the area. The pre-Cambrian gneisses, schists, and quartzites have been cut by aplites, quartz-feldspar pegmatites, and several unusually persistent, fine-grained basic dikes. These dikes strike northeast and dip steeply to the northwest. They may be traced along the strike for several miles and generally exceed 150 feet in width.

Scattered molybdenite crystals of small size occasionally are seen in the pegmatites and enclosing gneiss. Sampling of several basic dikes, pegmatite masses, and the adjoining gneisses showed them to contain up to 0.02 percent MoS_2 with traces of gold and silver.

Nancy (Au)

The Nancy is an unpatented lode claim in sec. 24, T. 6 S., R. 9 E., held by M. J. Pomajbo, Pray, Mont. Access to the property from Pray is over 11 miles of county and Forest Service roads eastward along the West Fork of Mill Creek.

The claim is reported to have been prospected for a short time during the search for outlying placer and lode deposits in the 1880's. A small placer working about 200 yards upstream from the Nancy is one of several along the West Fork reputedly opened and worked by Chinese before the turn of the century. No statistics of production from either placer or lode deposits along the West Fork are available. The property was unequipped and dormant in 1948.

A 30-foot adit and two shallow prospect pits have been opened on the Nancy claim a few feet above stream level. The adit has been driven into interbedded pre-Cambrian schists and quartzites containing small lenses of glassy, pegmatic quartz. These quartz lenses range from 2 to 8 inches in thickness. They strike N. 25° E. and dip 60° to 70° W., closely following the foliation of the enclosing schists.

No sulfides were observed in either the quartz lenses or the enclosing schist, although the quartz was stained with limonite in places. Samples chipped from the quartz bodies contained traces of gold and 0.1 ounce silver a ton.

Independence (Boulder River) Region

Several prospects and small mining areas in the Boulder River region Park and Sweet Grass Counties, Mont., are described in the following section. Access to this region is from Big Timber, Mont., south by county and Forest Service roads along the Boulder River. Big Timber (population 1,500) is on U. S. Highway 10 and the main transcontinental line of the Northern Pacific Railroad.

Although sporadically prospected since the 1860's, the region's limited production has been mainly from the Cowles-Independence district. Peak activity, reached during the early 1890's, resulted in the construction of several stamp-amalgamating mills and the boom town of Independence. The rush rapidly subsided to desultory prospecting and occasional short-lived operating ventures. The region has been dormant since 1934.

The greater part of the Boulder River region is underlain by Archean crystallines involved in the Beartooth uplift. The north margin of this area is marked by the westward-extending tongue of the Stillwater complex, which, in turn, is unconformably overlain by Cambrian quartzites, shales, and limestones. The Archean gneisses and schists to the south have been covered and intruded by Tertiary rocks, which include basic and acidic andesites, dacites, basalt, and quartz monzonite (1) (6).

Most of the region's known ore deposits are within or near a small diorite stock that cuts the extrusives about 1 mile east of Independence. Several small ore deposits have been found in the Paleozoic formation on the north. One prospect containing traces of nickel has been exposed in the basal horizon of the Stillwater complex.

Black Diamond (War Eagle) (Cu, Mo)

The Black Diamond property, in sec. 32, T. 6 S., R. 12 E., contains eight unpatented lode claims owned by Chas. Rasnick, McLeod, Mont. It is reached by 50 miles of improved county road south from Big Timber along the Boulder River and 3-1/2 miles of pack trail up Bridge Creek to the southwest.

The property was first prospected in 1878; it has been explored intermittently for 30 years. No ore has been produced. Underground development is by three short adits aggregating 500 feet in length. The vertical range of these adits is 240 feet, the lowest opening being at an altitude of 8,400 feet.

The openings partly explore a strongly mineralized contact zone in lower Paleozoic limestone overlain by dolerite. This zone strikes N. 65° E. and dips 60° to 73° NW. It has been partly explored over a length of 350 feet. Its greatest exposed width (lower adit) is 93 feet. Pyrrhotite, pyrite, a little chalcopyrite, and traces of molybdenite occur in a quartz-magnetite gangue. The grade of the exposed material, as indicated by preliminary sampling, is as follows:

	Range
Iron, percent	39.0-53.0
Sulfur, percent	0.002-0.064
Phosphorus, percent	.042- .150
Molybdenum, percent	.01
Copper, percent	.01-0.5
Gold	Trace
Silver, oz. per ton	0.5
Nickel	Nil

Float rich in iron, copper, and molybdenum minerals has been found along a zone extending several thousand feet south from the prospected area. Difficult access, dense forest cover, and deep overburden have, to date, tended to discourage aggressive exploration.

Boulder River Nickel (Riverside) (Ni-Cu)

The Boulder River Nickel prospect is in a group of seven unpatented lode claims in secs. 23 and 24, T. 4 S., R. 12 E., Sweet Grass County, Mont. These claims, held by Charles Blakeley and Charles Rasnick, McLeod, Mont., are reached by 35 miles of maintained county road along the Boulder River south from Big Timber, Mont.

No ores have been produced, although the property has been sporadically prospected for many years. The prospect was dormant in 1948.

A number of shallow pits and two short adits less than 100 feet long partly explore a zone in the basal horizon of the Stillwater complex. The zone, 12 to 30 feet wide, contains pyrite, pyrrhotite, chalcopyrite, and probably small amounts of pentlandite enclosed in hornfels.

A sample of massive sulfides selected from one of the adit dumps assayed as follows:

	Percent
Gold	Trace
Silver	Do.
Iron	23.1
Nickel	0.3
Copper	.3
Cobalt	.06

The Four Sevens (Pb, Ag)

The Four Sevens group consists of four unpatented lode claims in sec. 21, T. 7 S., R. 12 E., at an altitude of 8,000 feet. These claims, owned by Charles Blakeley, McLeod, Mont., are 54 miles south of Bit Timber by maintained county road along the Boulder River.

The deposit was reportedly discovered and briefly prospected in 1905. It was dormant until 1948, when a small open-cut was hand-excavated by Blakeley. No ore has been produced to date.

An open-cut about 20 feet long and 4 feet wide has exposed small amounts of finely disseminated galena and banded pyrite enclosed in a siliceous, metamorphosed, sedimentary rock overyling a granitic intrusive. The sedimentary rocks strike N. 75° to 80° E. and dip about 10° to the north. The magnitude of the deposit was not apparent from the limited prospecting done.

A 4-foot sample cut across the exposed mineralized zone contained 0.5 percent lead, 0.01 ounce gold, and 0.59 ounce silver a ton.

Red Fox (Au)

The Red Fox group in sec. 28, T. 4 S., R. 12 E., consists of six unpatented claims held by Charles Blakeley, McLeod, Mont. It is reached by 30 miles of improved county road along the Boulder River south from Big Timber, Mont., and 3 miles of pack trail up Great Falls Creek.

According to reports, a small amount of ore was mined from the property around the turn of the century. Most of this ore was treated in a 5-stamp amalgamating mill on Great Falls Creek. A few tons of ore was shipped to Anaconda for smelting. The property was idle in 1948.

A series of small prospect cuts, trenches, and a single short adit partly expose a mineralized fracture zone in dolerite over a distance of about 500 feet. This zone strikes N. 55° W., dips 50° to 80° N., and averages about 3 feet in width. The exposed parts of the structure contain pyrite enclosed in a limonite-stained siliceous gangue. A sample of the vein material cut over a width of 3 feet assayed as follows:

	Oz. per ton
Gold....................	0.69
Silver....................	Trace
	Percent
Iron....................	12.0
Nickel....................	Nil

Skiline (Pb, Ag)

The Skiline prospect in sec. 12, T. 7 S., R. 12 E., in Sweet Grass County, Mont., has been opened on one of two contiguous unpatented lode claims held by Frank Murray, West Yellowstone, Mont. The property is reached by 50 miles of county road south along the Boulder River from Big Timber and 3 miles of truck trail up the East Fork.

The only underground working is on the precipitous north slope 2,500 feet vertically above the floor of the East Fork Canyon, where a short adit has been driven at an altitude of 9,450 feet. A small cable tramway powered by an automobile engine has been used to lower ore from the workings to the canyon floor. The prospect may have produced up to 150 tons of ore. No shipping records or other production data are available.

A small mineralized siliceous deposit formed at the parting between quartzites and overlying shales of Paleozoic age is exposed in the adit. These sedimentary rocks appear to belong to a xenolith enclosed by granites, which comprise the main mountain mass. The xenolith has an apparent thickness of 200 feet; its horizontal extent could not be determined.

The fracture filling and replacement is about 2 feet thick. It strikes N. 63° W. and dips 3° to 5° SW. conformably with the bedding of the enclosing rocks. Medium-grained galena, anglesite, and minor pyrite accompanied by a siliceous gangue are the main vein constituents. A chip sample cut across the full width of the vein contained 10 percent lead, 0.02 ounce gold, and 6.84 ounce silver a ton.

Daisy (Au)

Four contiguous patented claims known as the Daisy group are in sec. 23, T. 7 S., R. 12 E., in Sweet Grass County, Mont., a short distance southeast from the Independence mine. The group is owned by the Cowles Mining Co., Boston, Mass.

The property is reputed to have produced gold-bearing ores during the years 1894-1897. Statistics covering this period of activity are not available. The claims were under lease in 1934 when a 35-ton gasoline-powered gravity concentrator was built. Local reports indicate that the plant was permanently shut down within a few months after its completion.

A vertical northwest-trending fissure in diorite has been developed by two adits and connecting raises over a horizontal range of about 250 feet. The vertical interval between the adits is 300 feet.

Inspection of the waste dumps indicated that the vein system contained both oxidized and pyritic gold ores in a siliceous gangue.

All workings on the Daisy property were inaccessible in 1948. Mine plant equipment had been almost completely removed. The mill building is in fair repair and still contains a small ball mill and two Wilfley tables.

Hidden Treasure (Au)

The Hidden Treasure group, consisting of six patented claims in sec. 23, T. 7 S., R. 12 E., in Sweet Grass County, Mont., is owned by the Cowles Mining Co., Boston, Mass. The property can be reached by truck trail a short distance southward from the Independence mine.

Nothing is known concerning the property's operation or past production. The principal workings, totally inaccessible in 1948, consist of three adits and a shaft. The underground development has an estimated horizontal range of 500 feet over a vertical interval of about 200 feet.

Material on the dumps indicates that these workings explore a fracture zone in sericitized diorite. Alignment of the adits and shaft suggests that the vein is nearly vertical and strikes to the northwest. It has been reported that the ores extracted were strongly oxidized and contained free milling gold in a siliceous gangue. Sulfide minerals other than pyrite were not in evidence in the dump material.

All equipment with the exception of a small Berdan pan has been removed from the property.

Independence (Au)

The Independence property includes 35 patented and unpatented lode claims in secs. 14 and 23, T. 7 S., R. 12 E., Sweet Grass County, Mont. It is owned by the Independence Consolidated Mines Co., Big Timber, Mont. Access from Big Timber is by 56 miles of improved mountain road up the Boulder River, thence by 3 miles of steep truck trail to the old Cowles camp. Cowles Camp is at an altitude of 8,500 feet.

The Independence mine is reputed to have been active during the periods 1894-1897, 1900-1904, and in the 1930's. No reliable data regarding mine production are available. Statistics for Sweet Grass County during the years 1895-1898 and 1901-1904 record a total county production of 111 ounces gold and 926 ounces silver. Records for the years 1894, 1899, and 1900 are not available. During the period 1930-1939 county records indicate a total of 272 tons of ore containing 62 ounces gold and 909 ounces silver was produced. According to local reports, a small tonnage was mined from the Independence workings in the 1930's. This ore was unsuccessfully treated in a small gravity concentrator on the adjoining Daisy property. The ruins of a 10-stamp amalgamating mill built in 1899 to treat the Independence ores can be seen at the junction of Basin Creek and the Boulder River.

The Independence vein is a narrow fracture filling and replacement in diorite striking northwest and essentially vertical in dip. Oxidized ores containing free gold in a siliceous gangue reportedly constituted the greater part of the property's production. The primary ore, essentially auriferous pyrite in a quartz gangue, could not be treated without prohibitive losses by the available milling equipment.

The principal mine workings are two adits driven over an estimated horizontal range of 500 feet and a vertical interval of 100 feet. The total length of these workings, including raises, is probably little more than 1,000 feet. Both adits were inaccessible in 1948. All equipment has been removed from the property.

Big Timber Creek Area

The following discussion concerns a small area on the upper reaches of Big Timber Creek in Sweet Grass County, Mont. The limited and sporadic prospecting accomplished to date has failed to indicate the existence of widespread mineralization of economic importance. The area has not attracted sufficient attention to be recognized as a mining district.

The Big Timber Creek area is on the eastern slope of the rugged Crazy Mountains about 21 miles airline northwest from Big Timber, Mont. Access

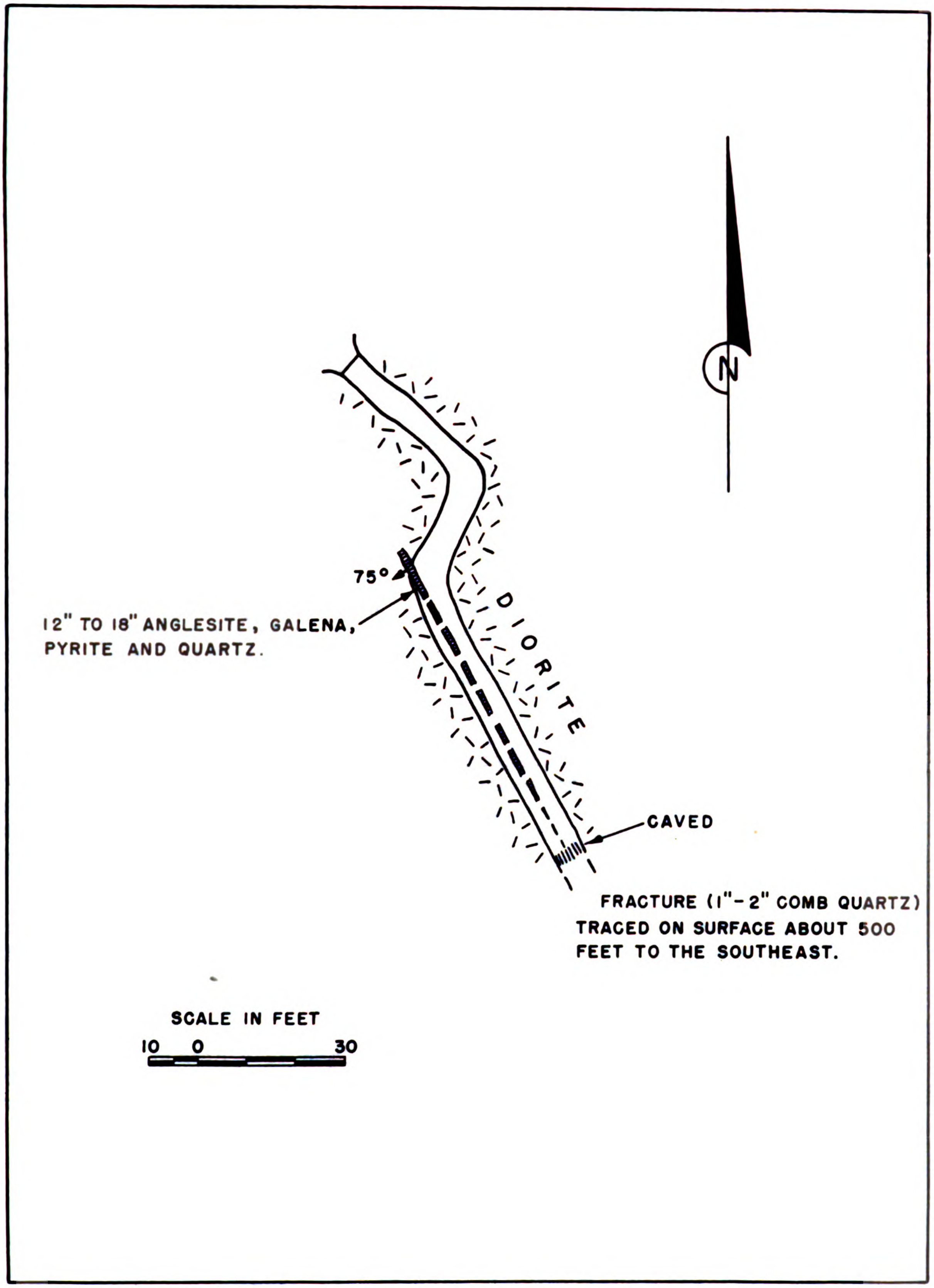

N
75°
12" TO 18" ANGLESITE, GALENA, PYRITE AND QUARTZ.
DIORITE
CAVED
FRACTURE (1"-2" COMB QUARTZ) TRACED ON SURFACE ABOUT 500 FEET TO THE SOUTHEAST.
SCALE IN FEET
10 0 30

Figure 13. - Stemwinder prospect, Big Timber Creek area, Sweetgrass County, Mont.

from Big Timber is by 5 miles of State Highway 19 and 10 miles of county road ending at the Van Cleve ranch. A 5-mile pack trail along Big Timber Creek leads to the prospected area.

The area is precipitous, heavily forested, and abundantly watered by Big Timber Creek and its numerous tributary streams and glacial lakes. Nearby mountain peaks exceed 10,000 feet in altitude. The prospected area is between 8,000 and 9,000 feet above sea level. Access is hampered by heavy snows during at least 6 months of the year.

The Crazy Mountains are highly indurated, relatively flat-lying Cretaceous sediments surrounding intrusive cores of Eocene age (1). The region's marked relief stems directly from the effects of differential erosion upon the comparatively soft, unaltered Livingston beds and the hardened beds adjacent to the intrusive masses.

The stocks comprising the central cores of the mountains are diorite, granodiorite, and granite plus an unusual assemblage of andesites, trachytes, and other flow rocks (7). The known lode deposits in the Big Timber Creek area are confined to the diorite.

Stemwinder (Pb, Ag)

The Stemwinder prospect is on unpatented ground in sec. 6, T. 3 N., R. 12 E., formerly held by the Belle Mining Co., Butte, Mont. Access to the prospect is by 15 miles of State highway and graveled roads northwest to the Van Cleve ranch on Big Timber Creek and 5 miles of pack trail skirting Blue Lake.

According to local reports, the prospect was discovered and briefly worked about 1900. In 1929 a small shipment of ore is said to have been made to the A. S. & R. smelter at East Helena, Mont. Confirmation of this shipment is not, however, evident from the available production statistics for Sweet Grass County. The claim has been dormant since 1929.

A short adit at an altitude of 8,200 feet has exposed a mineralized fissure enclosed in coarse-grained diorite striking N. 30° to 40° W. and dipping 75° SW. (fig. 13). The vein outcrop, 6 inches to 2 feet in width, is exposed over a strike length of 300 feet or more. A series of minor topographic depressions suggests a strike length of about 1,000 feet.

The ore consists of anglesite, galena, and pyrite with minor amounts of bornite in a quartz gangue. A character sample cut from the adit working over a width of 1 foot assayed:

	Oz. per ton
Gold......................	0.16
Silver....................	27.7
	Percent
Lead......................	49.5
Copper....................	0.9
Zinc......................	.05

The adit is open for a distance of 125 feet in from the portal. Its total length is unknown but probably does not exceed 200 feet. All equipment has been removed from the property.

Kelly

The Kelly prospect, formerly held by the Belle Mining Co., Butte, Mont., is in sec. 6, T. 3 N., R. 12 E., about three-quarters of a mile north from the Stemwinder. The deposit was discovered in 1900 and was last explored in 1929. No ore has been mined.

A single adit, entirely in diorite, has been driven for a distance of 500 feet along a narrow vertical fracture striking about N. 25° W. Streaks of limonite-stained gouge ranging from 1 to 6 inches in width mark the course of the fracture throughout its explored length. Vein quartz and sulfide minerals appeared to be entirely absent from that part of the structure exposed by the adit.

NONMETALLIC MINERAL OCCURRENCES

The development and exploitation of nonmetallic deposits in Park County, Mont., has been retarded largely by the lack of local commodity outlets and the generally high freight charges to existing markets. Consequently, the value of nonmetallic mineral production from the county has remained comparatively small to date.

The following section presents information concerning two nonmetallic deposits exploited in Park County in recent years. Both are currently inactive.

Calcite Deposits

A number of calcite deposits have been recognized over the years along the Yellowstone River drainage basin in south-central Montana. These deposits occupy a zone about 63 miles long trending N. 50° W. through parts of Stillwater, Sweet Grass, and Park Counties, Mont. (fig. 14). Most of the known and recently productive deposits are in Park County between Springdale on the east and Wilsall on the west.

A few of these deposits had been exploited in a small way to produce small amounts of locally consumed chicken grit. Others occasionally supplied a few crystals suitable for Nichol prisms and collector's specimens. In 1942 an urgent demand for near-optical grade calcite was created through the adoption of an optical ring sight by the armed forces. The consequent intense exploration and development resulted in the production of a substantial quantity of near-optical grade calcite from the Park County deposits.

Several ventures were undertaken to supply the Polaroid Corp., Cambridge, Mass., with raw material for ring-sight fabrication. One of the earliest and most productive operations began in October 1942 on the Wade property (fig. 15) In May 1943, Calcite Operators, Inc., and its subsidiary, Crystal Cutters, Inc., were organized to speed production from the Wade deposit and also to

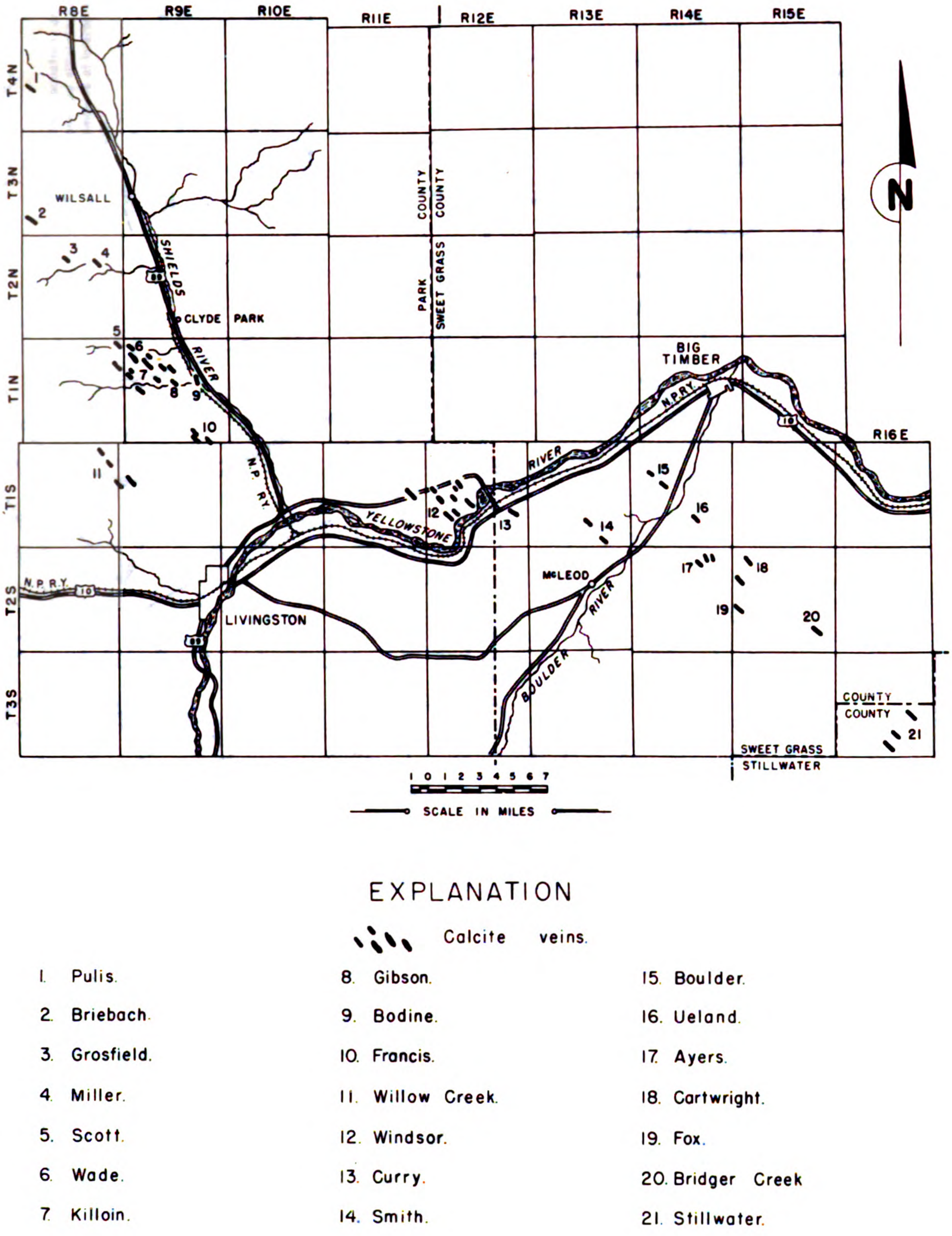


Figure 14. - Calcite deposits of south-central Montana.

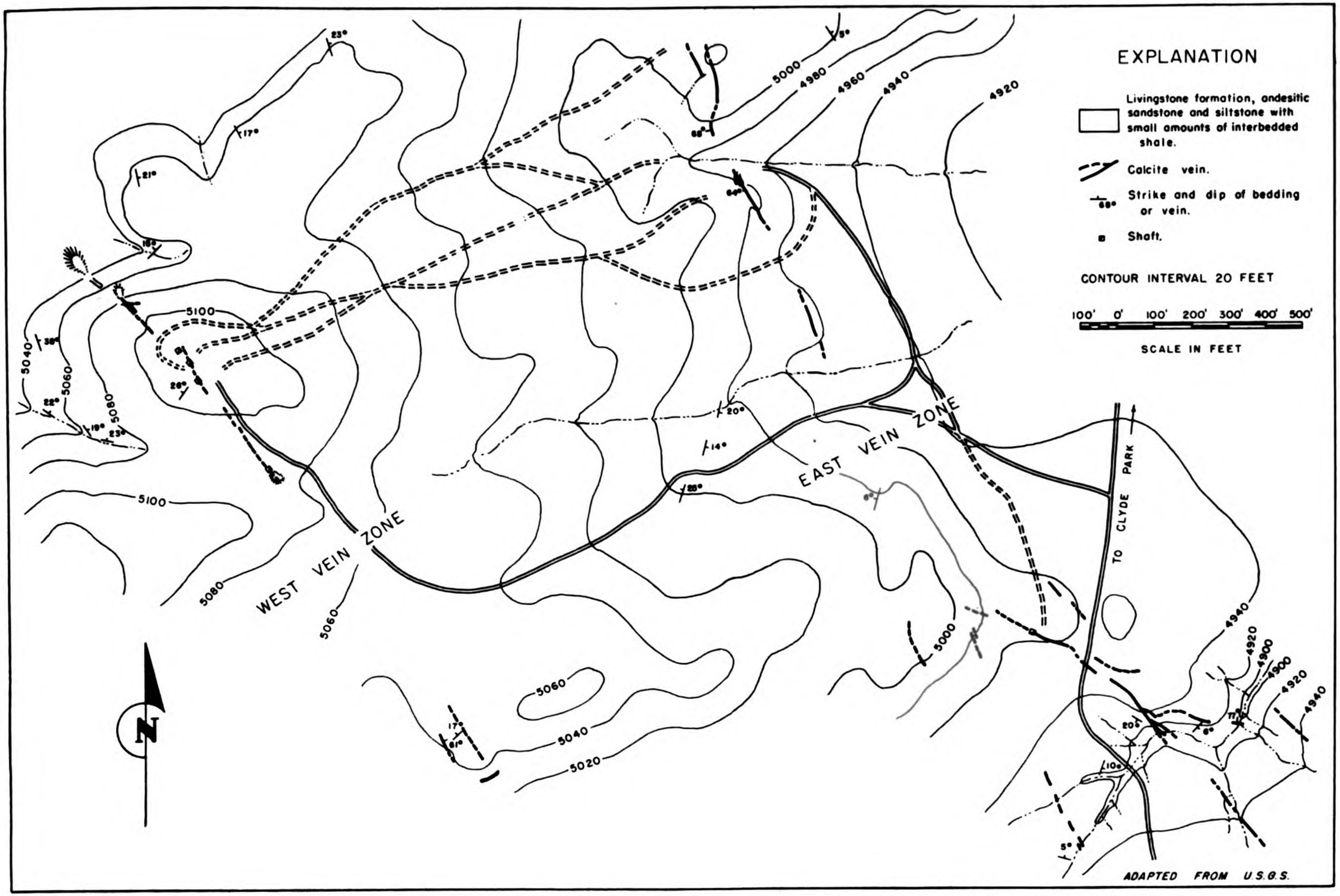


Figure 15. - Wade calcite deposits, Clyde Park, Park County, Mont.

provide custom sorting and field processing facilities for raw material taken from other deposits in the region. Financial and legal involvments obliged these organizations to terminate activities in October 1943, whereupon operations were assumed by the Metals Reserve Corporation. Steady production then was maintained until the demand for near-optical grade calcite ceased in September 1944.

Reliable production records for most of the individual properties are either incomplete or entirely lacking. The Wade deposit is credited with production of 5,340 pounds of acceptable material up to December 1943. The Francis, Breibach, and Killoin properties are credited with an aggregate production of 335 pounds during the same period.

The calcite deposits are in a broad, northwest-trending, synclinal basin in the late Cretaceous Livingston formation. This formation is a great thickness of agglomerates, sandstones, siltstones, shales, and occasional intercalated andesites. In general, the Livingston beds strike northward and dip gently to the east or west. Minor folds trending northeast to east are common to most of the calcite fields, as are a system of joint sets that strike northeast, northwest, and west.

Most of the deposits are enclosed by andesitic sandstones. Several deposits, however, have been found in andesite. Calcite has been hydrothermally emplaced in fractures and joints that strike predominantly northwest. These openings evidently are tension cracks developed along with the northeast-trending folds by pressure from the northwest.

The structures containing calcite usually are disposed in a rude en echelon pattern, with minor outliers and branching veinlets, which together comprise broad zones. These zones strike northwest, although the individual units may strike nearly north. Individual veins range in width from a few inches up to 15 feet or more; their average width is about 4 feet. In length they extend from less than 100 feet to more than 2,000 feet. Although these structures are well-defined and persistent, they are not continuously filled with calcite.

Calcite occurs in veinlets, stringers, and lenses within the vein structures. The vein walls often are brecciated and recemented with calcite and chalcedony. The lenses are composed of white, or brownish-yellow, opaque calcite sometimes coated with drusy stilbite.

Optical and near-optical grade material is occasionally found lining vugs within the calcite lenses. The vugs range from less than a cubic foot to more than 3,000 cubic feet in volume. Only a small percentage of the crystals lining the vugs are suitable for optical use. Further, the entire mass of any individual cyrstal rarely is sufficiently free of imperfections to be wholly usuable. For instance, the largest single crystal found during mining weighed 300 pounds; 30 pounds of acceptable material was recovered from this crystal. Individual crystals containing usuable portions ranged from several ounces to 50 pounds or more. Most of the crystals extracted for sorting, however, ranged from 1 to 7 pounds in weight. The chemical character of typical vein calcite is indicated by the following analysis:

	Percent
CaO	55.9
SiO_2	0.22
MgO	.09
Al_2O_3	.08
Fe_2O_3	.08
P	.01
S	.01
As	1/.01

1/ Less than.

The numerous calcite deposits of south-central Montana vary greatly in size and persistence. However, they are all intimately linked in origin, mode of occurrence, and mineralogy. The following description of one of the most productive calcite mines essentially typifies the broader relationships existing at the region's other prospects.

The Wade deposits are in sec. 7, T. 1 N., R. 9 E., on grazing owned by W. W. Wade, Clyde Park, Mont. The property is 4 miles by unimproved county road southwest of Clyde Park, which is 24 miles north of Livingston by U. S. Highway 89.

During World War II, mineral rights to the property were acquired by the Polaroid Corp., Cambridge, Mass. Production up to December 1943 amounted to 5,340 pounds of material acceptable for purchase. For each pound of acceptable material produced, about 1,183 pounds of vein material was mined and sorted.

Two vein zones in andesitic sandstone and siltstone have been found in the Wade area. These nearly parallel zone strike N. 35° to 40° W. and dip steeply to the southwest. They are separated by an apparently barren interval of 1,500 feet. The east zone has been identified over a strike length of about 2,700 feet. The more productive west zone has an indicated length of 1,500 feet. The productive west zone consists of several en echelon units ranging from 10 to 400 feet in length and from several inches to more than 6 feet in width. These units strike from N. 30° to 43° W. and dip from 60 SW. to vertical (8).

The veins contain wall rock breccias, sandy gouge, calcite veinlets, stringers, and lenses. Slip striae on the vein walls indicate both strike and dip movement of small magnitude (8).

The most productive lens found during mining was 80 feet long and 6 or more feet thick. This lens contained a central vug about 70 feet long, 30 feet deep, and 3 feet wide. Crystals of clear calcite weighing up to 10 pounds were taken from the vug walls and from the sand fill covering the floor of the chamber (8).

The vein was prospected and exploited through several shallow open-cuts, four shafts ranging from 40 to 65 feet in depth, and a 470-foot drift adit. Stoping above the sill level was done by a modified shrinkage system. Because of the fragile character of the calcite crystals, much of the excavating in and approaching the vugs was done by hand.

Gardiner Travertine

The Gardiner travertine deposits occupy parts of secs. 14, 15, 22, 23, and 24, T. 9 S., R. 8 E. This area is a short distance north of Gardiner and is reached by 2 miles of improved mountain road north from U. S. Highway 89 and the Gardiner townsite. Three tracts, embracing an area of 1,250 acres, are held under separate ownership by Helen McCarn, Billings, Mont., the McMurron estate, Billings, Mont., and the Northwestern Improvement Co., St. Paul, Minn.

The deposits have occasionally supplied small amounts of stone for local lime burning. A cement-manufacturing project was abandoned shortly after the initial preparation of a plant site was completed. In 1932 a small-scale quarrying operation for decorative stone was established by the Northwestern Improvement Co. Quarrying operations, which continued until 1942, resulted in the production of 8,450 tons of decorative stone. Peak annual output was reached in 1939 with the production of 1,300 tons. The quarried blocks were shipped to eastern centers for sawing and polishing. In 1947 a few tons of stone quarried prior to 1942 was contract-loaded and shipped to Carthage, Mo. for finishing. The quarry was idle in 1948.

Travertine has been deposited on a terrace of basalt, volcanic breccia, and Pleistocene gravels over a distance of 1-1/2 miles. A fault zone striking N. 65° W. apparently marks the channel through which ascending thermal solutions traveled to build the deposits.

An area 2,500 feet wide and 3,300 feet long has been explored and partly developed by a series of test pits, drill holes, and quarries. The travertine in this area ranges from several feet to 30 feet in thickness. Bedding generally is horizontal except where locally distorted by slump. The directions of dominant jointing and fracturing appear to be controlled largely by the northwest striking fault.

The stone is hard and compact, horizontally banded, and of a variety of colors and textures. Its specific gravity is about 2.69. A typical chemical analysis of the rock follows:

	Percent
SiO_2..........................	0.05
Fe_2O_3........................	.04
$CaCO_3$........................	99.74
$MgCO_3$........................	.07
$CaSO_4$........................	.00
P............................	.00
Organic material............	.00

Compression tests on a 6-inch cube indicated an ultimate strength of 8,188 p.s.i. at a maximum load of 294,760 pounds (9).

The total reserves of the deposits have been estimated at 35,000,000 tons. The probable available raw material reduced by 50 percent losses during quarrying may amount to about 5,900,000 tons. Additional losses during sawing and polishing would amount to 20 or 30 percent (9).

In quarrying, the blocks are first outlined by closely spaced jackhammer holes and then broken out by wedging. No saws or explosives are used. No equipment other than a small gasoline-powered loading winch was on the property in 1943.

The small power requirement for quarry operation is limited to air compression and loading equipment. Substantial savings in rail freight could be made, provided the quarried blocks were sawed and polished locally. A plant capable of producing finished travertine has been estimated to require about 200 connected horsepower.

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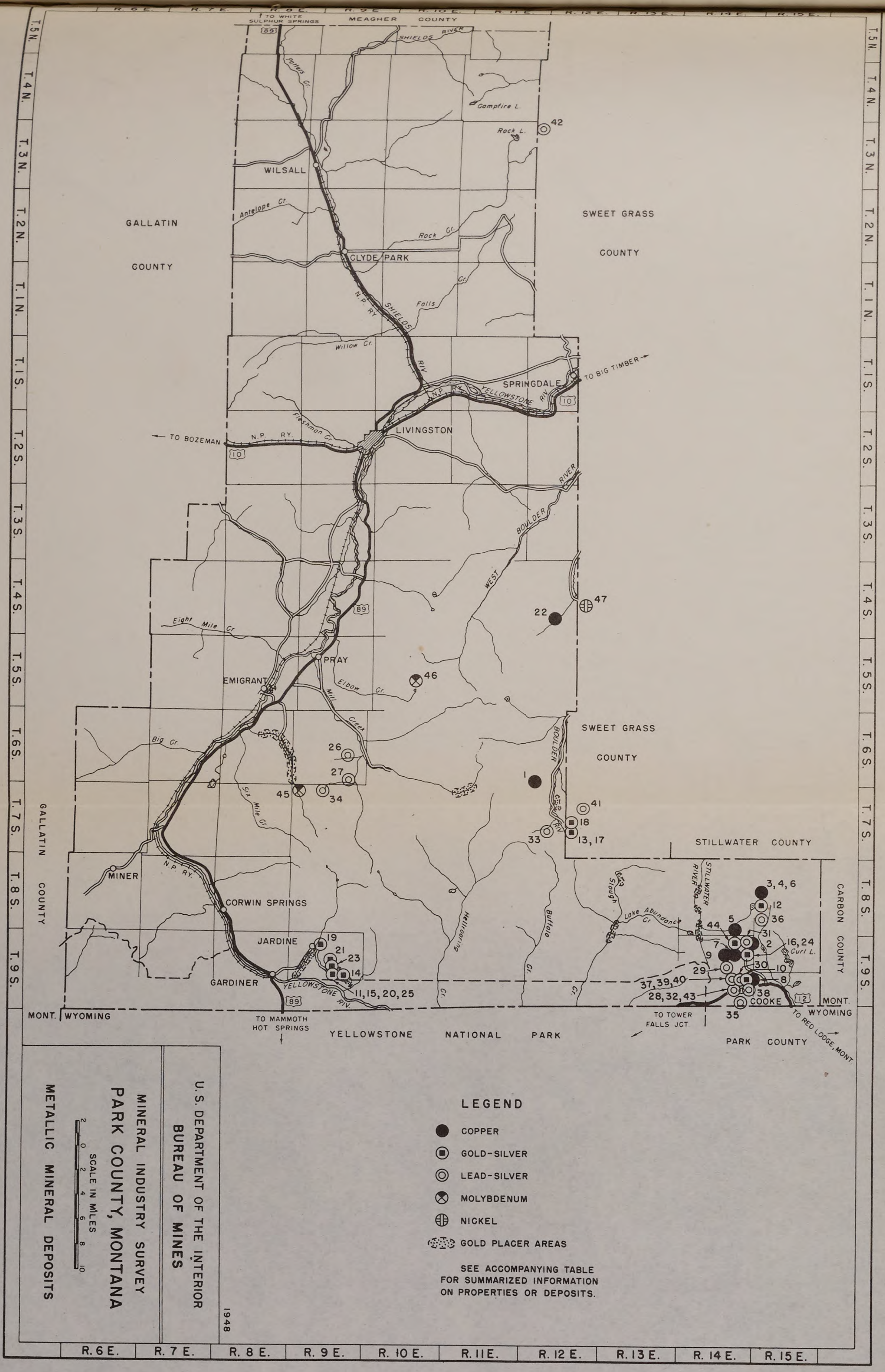
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
MINERAL INDUSTRY SURVEY
PARK COUNTY, MONTANA
METALLIC MINERAL DEPOSITS
SCALE IN MILES
1948
LEGEND
● COPPER
GOLD-SILVER
◎ LEAD-SILVER
MOLYBDENUM
NICKEL
GOLD PLACER AREAS
SEE ACCOMPANYING TABLE FOR SUMMARIZED INFORMATION ON PROPERTIES OR DEPOSITS.
MEAGHER COUNTY
GALLATIN COUNTY
SWEET GRASS COUNTY
STILLWATER COUNTY
CARBON COUNTY
PARK COUNTY
YELLOWSTONE NATIONAL PARK
MONT.
WYOMING
WILSALL
CLYDE PARK
SPRINGDALE
LIVINGSTON
PRAY
EMIGRANT
MINER
CORWIN SPRINGS
JARDINE
GARDINER
COOKE
TO WHITE SULPHUR SPRINGS
TO BIG TIMBER
TO BOZEMAN
TO MAMMOTH HOT SPRINGS
TO TOWER FALLS JCT.
TO RED LODGE, MONT.
YELLOWSTONE RIV.
SHIELDS RIV.
BOULDER RIVER
WEST BOULDER
N.P. RY.
R. 6 E.
R. 7 E.
R. 8 E.
R. 9 E.
R. 10 E.
R. 11 E.
R. 12 E.
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T. 8 S.
T. 9 S.

Figure 16.

MINERAL INDUSTRY SURVEY TABLE
PARK COUNTY, MONT. 1948
Metallic Mineral Deposits

Map ref. no.	Name of property or deposit	Location			● - Copper	Indicated metal content	Reported production	Remarks
		Sec.	T.	R.	Description of deposit			
1	Black Diamond (War Eagle)	32	6S	12E	Steep-dipping contact zone in limestone overlaid by dolerite. Auriferous pyrrhotite with traces of molybdenite and copper in quartz-magnetite gangue.	Cu-0.1-0.5%, Fe-39%, Mo-0.01%.	None	Partly explored over length of 350 feet. Rich copper-molybdenum float found in vicinity. Located in 1878. Developed intermittently over a period of 30 years. 3 adits caved.
2	Commonwealth	1	9S	14E	Narrow fracture filling in quartzite. Ore minerals predominantly pyrite and chalcopyrite.	Ag-4.5 oz., Au-0.1 oz., Cu-1.7%.	None	--
3	Copper Index	19	8S	15E	Chalcopyrite associated with feldspar gangue in syenite.	?	None	Very isolated - high altitude. Possibly magmatic segregation. No further information available.
4	Copper King	18	8S	15E	Possibly syngenetic deposit in small syenite plug. Ore predominantly chalcopyrite in feldspar gangue. Widths reported from several feet up to 20 feet wide.	Selected ore from dump 10% Cu, 1.69 oz. Ag, 0.03 oz. Au, 0.04 oz. Pt.	None	Workings inaccessible. Shaft caved and flooded.
5	Elizabeth	35	8S	14E	Narrow fracture filling in Archean granite. Ore minerals chalcopyrite, argentite, and pyrite.	?	None	--
6	Hecela-Flora	18	8S	15E	Narrow sheeted zone in syenite and granodiorite. Ore minerals chalcopyrite, galena, limonite.	?	None	Surficial exploration only.
7	Homesteke (Parkmont, Excello)	11	9S	14E	Contact metamorphic deposit containing chalcopyrite and auriferous pyrite along complex irregular fracture network in limestone adjacent to monzonite porphyry.	1.0% Cu, 0.15 oz. Au.	Present rate about 70 tons daily.	Currently operating on ores extracted by open-cut methods at altitude of 9,700 feet. Flotation-jig-amalgamation plant.
8	Longstreet	24	9S	14E	Disseminated deposit in limestone containing pyrite and chalcopyrite.	?	None	--
9	McLaren	10,11	9S	14E	Disseminated pyritic gold copper minerals in limestone adjoining monzonite porphyry. Deposit flat-lying-ranges from 20 to 40 feet thick.	Ranges from 0.1-0.4 oz. Au and 0.8-1.5% Cu.	824 tons copper, 36,000 oz. gold. Annual production rate - 40,000 tons.	Ores extracted by open-cut methods at altitude of 9,650 feet. Mining limited by weather conditions to 6-month period annually. Flotation and gravity mill treating 185 tons ore daily.
					◉ - Gold-Silver			
10	Alice E.	24	9S	14E	Steeply-dipping zone up to 250 feet wide and 1,000 feet long in quartzite adjacent to small gabbro plug. Contains massive auriferous pyrite in siliceous gangue.	Oxidized ore cyanided 1893-1895 reported to contain $14/ton in gold.	2,500 tons during period 1893-95.	Workings inaccessible.
11	Conrad	22	9S	9E	Gold-bearing quartz lenses in Archean schist extend over a length of 2,000 feet and a vertical range of 600 feet, comprise a lode 10 to 40 feet wide.	Ranges up to 0.3 oz. Au a ton.	Minor	Property idle - workings generally inaccessible.
12	Copper Glance	19	8S	15E	Steep-dipping fracture up to 10 feet wide in Archean granite. Contains disseminated minerals and galena, sphalerite, and pyrite in quartz gangue.	0.6 oz. Au, 1.6 oz. Ag, 0.3% Pb.	None	--
13	Daisy (Duffy)	23	7S	12E	Narrow, vertical fissure in diorite contains siliceous gangue enclosing auriferous pyrite.	?	Reputed to have produced small amount of gold in 1890's.	Some production 1894-97 by Independence Consolidated Mining Co. Briefly operated in 1934 with 35-ton gravity plant. Idle since that date. Workings inaccessible.

3420

MINERAL INDUSTRY SURVEY TABLE
PARK COUNTY, MONT. 1948
Metallic Mineral Deposits (Continued)

Map ref. no.	Name of property or deposit	Location Sec.	T.	R.	Description of deposit	Indicated metal content	Reported production	Remarks
					■ - Gold-Silver (Contd)			
14	Dryden	23	9S	9E	Gold-bearing quartz pods in Archean schists comprise a lode about 3 feet wide.	Low - probably less than 0.03 oz. Au.	None	--
15	First Chance	22	9S	9E	Gold-bearing quartz lenses from several inches to 10 feet wide in Archean schists.	Low - probably less than 0.03 oz. Au.	Small	Last operated in 1939. Most wor ings inaccessible.
16	Glengarry	12	9S	14E	Contact-metamorphic deposit in limestone containing pyritic gold-copper ores. Explored over length of 2,300 feet and vertical range of 450 feet.	Low	None	Idle since 1927; workings inacces ble. Old 25-ton mill.
17	Hidden Treasure (Eastern Star)	23	7S	12E	Narrow fracture zone in sericitized diorite containing pyrite and free gold in siliceous gangue.	Probably low.	Small production 1894-97.	Workings inaccessible - had small mill.
18	Independence	14,23	7S	12E	Steep-dipping, narrow fracture filling and replacement in diorite. Auriferous pyrite in siliceous gangue.	Low	Reported to have made small production 1894-97 and 1900-04.	Workings inaccessible - had 10-stamp mill.
19	Jerdine	4,9	9S	9E	Moderate-dipping lode system composed of quartz veins, lenses, and cummingtonite in Archean schists. Gold associated with arsenopyrite in cummingtonite. Small amount of tungsten.	Low, 0.16 oz. Au, 1-2% As, less than 0.1% tungsten.	Rate: 350 tons/24 hours. 634,000 tons mined since 1932.	Operation suspended pending recon- struction of cyanide plant destro by fire in 1948. Flotation and arsenic recovery plant.
20	McCauley	22	9S	9E	Gold-bearing quartz lenses, 1 to 3 feet thick, in chloritized Archean schists.	Low	None recorded.	Scheelite said to have been produ in 1917-18. Workings inaccessib
21	Medona	15	9S	9E	Flat-dipping quartz lenses containing disseminated arsenopyrite and gold. Local scheelite segregations.	Low	Small	Workings inaccessible. Scheelit valued at $2,500 reputedly produ 1917-18.
22	Red Fox (Red Bird, Gray Eagle)	28	4S	12E	Mineralized fissure 3 feet wide in dolerite containing auriferous pyrite in siliceous gangue.	0.69 oz. Au, trace Ag. B.M. 3-foot sample.	Small - several tons smelted at Anaconda.	One 60-foot adit and surface cut Had 5-stamp mill.
23	Snowshoe (Hulse)	15,22	9S	9E	Quartz stringers comprise lode about 5 feet wide in garnetized Archean schist. Quartz has low gold content. Arsenopyrite, pyrite with some scheelite.	0.08 oz. Au, WO_3-0.55% (?)	Reported 6,000 tons valued at $25,000.	Idle since 1940; workings inacces ble.
24	Tredennick	12	9S	14E	Sheeted zone in pre-Cambrian granite along gabbro contact contains auriferous pyrite and chalcopyrite.	Up to 0.5 oz. Au a ton.	No production recorded.	Idle since 1924; workings inacces ble.
25	Watson	22	9S	9E	Flat-dipping lode, 5 to 12 feet wide, composed of quartz lenses containing arsenopyrite, scheelite, gold, and pyrite. Enclosing rock - quartz biotite schist.	Up to 0.3 oz. Au a ton.	800 lb. scheelite in 1917-1918.	Idle; workings inaccessible.
					◎ - Lead-Silver			
26	Alice C.	23	6S	9E	Narrow steep-dipping fracture, 3 to 8 inches wide, in pre-Cambrian schist contains quartz stringers with galena, sphalerite, and pyrite.	Owners 100 lb. sample to I. S. & R. Co. - 27.0% Pb, 3.5% Zn, 12 oz. Ag/ton.	None	Property idle since 1904.
27	Barbara Anne	35	6S	9E	Narrow, steep-dipping fracture fill and replacement in basic andesite. Galena, copper sulfides, and some sphalerite in quartz-pyrite gangue.	1.3% Pb, 1.8% Cu, 11 oz. Ag/ton.	Less than 100 tons.	Operations suspended in late 194

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MINERAL INDUSTRY SURVEY TABLE
PARK COUNTY, MONT. 1948
Metallic Mineral Deposits (Continued)

Map ref. no.	Name of property or deposit	Location Sec.	T.	R.	◎ - Lead-Silver (Contd) Description of deposit	Indicated metal content	Reported production	Remarks
28	Big Blue	26	9S	14E	Small lenses and stringers of galena and cerussite accompanied by pyrite in siliceous gangue. Wall rock - dolomitic limestone crushed by faulting. Also gold, silver, copper, zinc.	20-30% Pb, 9 oz. Ag/ton.	Small shipment in 1880's. 152 tons in 1910.	Underground workings idle since 1941, now inaccessible. Bulldozing produced 1,000 lb. ore in 1947, but uncovered no ore in 1948.
29	Black Warrior	14,15	9S	14E	Narrow, steep-dipping fracture fill and replacement in limestone contains small lenses of galena and associated sulfides. Siliceous gangue.	17% Pb, 14 oz. Ag/ton, 0.64 oz. Au/ton.	No record of early-day shipments. 41 tons ore shipped in 1945.	Idle since 1945. One adit open. Shaft inaccessible.
30	Carlton	24	9S	14E	Steep-dipping narrow fracture in gabbro contains siliceous gangue accompanied by galena, tetrahedrite and other sulfides.	700 lb. ore reported to have netted $375.	20 tons crude ore.	Workings inaccessible; last worked in 1906.
31	Chipmunk	1	9S	14E	Narrow, steep-dipping fracture 3 inches wide in gabbro containing galena and associated sulfides.	Reported $75 a ton.	None.	Idle for many years.
32	Duke	26	9S	14E	Galena, sphalerite, and pyrite in siliceous gangue in veins in limestone.	Reliable information lacking.	Produced some lead ore before 1885.	2 adits, 1 shaft, all ineccessible. Some new work in 1925 failed to indicate ore.
33	Four Sevens	21	7S	12E	Sparsely disseminated galena and pyrite in sedimentary rock overlying granite. Magnitude not evident.	Low grade.	None.	Prospect stage only. Active for short period in 1948.
34	Galena Queen	4	7S	9E	Vertical gash structure 2 to 12 inches wide in sheeted rhyolite contains seams of coarse galena with chalcopyrite, sphalarite, and pyrite. Parallel sheeted zone 400+ feet contains desseminated galena. Bog manganese in vicinity.	Wall rock contains 0.1% Pb, Ag, traces Au.	Unknown - small.	Difficult access. Merits further study. 1 shaft flooded. 1 adit.
35	Irma - Republic	35,36	9S	14E	Steep-dipping fracture fill and replacements in limestone. Ore - complex, lead-zinc-silver in siliceous gangue marked by manganese carbonates and oxides.	Milling: 4% Pb, 5% Zn, 12 oz. Ag. Shipping: 20% Pb 6% Zn, 40 oz. Ag.	Rate: 35-50 tons/24 hours.	Manganiferous gangue may merit study as possible future manganese source. 35-ton selective flotation plant.
36	Lazy Beetle	30	8S	15E	Narrow fracture 6 inches wide in Archean granite. Copper, lead, and zinc sulfides in quartz pyrite gangue.	25 oz. Ag/ton, 2.8% Zn.	None.	Actively prospected in 1925.
37	Morning Star	23	9S	14E	Vertical fracture about 3 feet wide in dolomite. Lead, copper, and silver sulfides in siliceous gangue.	?	40 tons shipped in 1922 reported to have netted $93 in lead and silver.	Some production in 1880's. 2 adits now inaccessible.
38	Mohawk Warrior	25	9S	14E	Narrow, steep, tight fracture in quartzite containing occasional 2-inch seams of galena.	56% Pb, 720 oz. Ag/ton	None	Being prospected in 1948.
39	New World	23	9S	14E	Flat-lying replacement pipes in limestone. Average cross section about 7' x 7'. Siliceous gangue. Galena, cerussite, and iron oxides.	No information.	Early - 2,000 tons sulfide ore.	Active prior to 1886; briefly prospected in 1907 and 1947. Adits caved.
40	Shoo Fly	23	9S	14E	Replacement pipe in limestone adjacent to monzonite porphyry dikes.	No information.	2,000 to 3,000 tons.	Reported as principal source of lead-silver ore in 1880's.
41	Skiline (Mountain View)	12	7S	12E	Mineralization along parting between quartzites and shales. Sediments may be Xenolith.	10% Pb, 6.8 oz. Ag/ton.	Possibly up to 150 tons ore.	Prospect idle in 1948. One 75-foot adit.
42	Stemwinder	6	3N	12E	Steep and narrow fracture in coarse diorite 6 inches to 2 feet wide. Anglesite, galena, and minor amounts of bornite in a quartz pyrite gangue.	49% Pb, 28 oz. Ag/ton, 0.16 oz. Au/ton.	Small shipment reputed to have been made to E. Helena smelter.	Idle since 1929; difficult access.
43	Stump	26	9S	14E	Flat-lying lenses up to 2 feet thick in limestone. Galena, chalcopyrite and sphalerite in a quartz-pyrite gangue.	No information.	Unknown - none recently.	Idle since 1887. 3 adits, 1 shaft, now inaccessible.

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MINERAL INDUSTRY SURVEY TABLE
PARK COUNTY, MONT. 1948.
Metallic Mineral Deposits (Continued)

Map ref. no.	Name of property or deposit	Location Sec.	T.	R.	◎ - Lead-Silver (Contd) Description of deposit	Indicated metal content	Reported production	Remarks
44	U. S. Treasury	2	9S	14E	Mineralized shear in Archean granite, contains irregular bunches of sulfides in a quartz and carbonate gangue. Galena, chalcopyrite, arsenopyrite predominate.	Reputed: 75-300 oz. Ag/ton.	None.	Prospected in 1880's; workings inaccessible.
					⊗ - Molybdenum			
45	Emigrant Gulch Molybdenum	6	7S	9E	Fractured and brecciated trachyte porphyry pipe about 150 feet in diameter. Openings filled with molybdenite, pyrite, and traces of gold and silver.	Central zone: 0.3-1.1% MoS_2; development average - 0.07% MoS_2, 0.03 oz. Au.	None.	Prospect only; explored in 1947.
46	Mt. Cowan Molybdenum	22	5S	10E	Scattered molybdenite crystals in pegmatites and enclosing gneiss.	Low grade 0.02% MoS_2 traces Au-Ag.	None.	Unexplored prospect.
					⊕ - Nickel			
47	Boulder River Nickel	23,24	4S	12E	Two exposures along basal horizon of Stillwater complex, 12 to 30 feet wide, containing pyrite and pyrrhotite with minor amounts of nickel and cobalt.	Selected sample from dump of caved adit - 0.3% Ni, 0.06% Co, 0.3% Cu.	None.	2 short adits; one caved.